Blue Growth

Scenarios and Drivers for Sustainable Growth from the Oceans, Seas and Coasts

Maritime Sub-Function Profile Report
Short Sea Shipping (1.2)

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The research for this profile report was carried out in the period April – August 2011. This report has served as an input to the main study findings and these have been validated by an Expert meeting held on 9/10th November 2011 in Brussels. The current report serves as a background to the Final Report on Blue Growth.

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Summary description

Short sea shipping is an important transport mode in the European transport network, catering to approximately 40% of all intra-European transport. The sector is considered mature, but does still show some economic growth. Technology development, both at the shipbuilding stage and in areas such as security and surveillance, mainly relates to public policy initiatives.

The transported volumes of cargo will generally develop along with economic development. Additional growth of volume may be realised by stimulating modal shift, provided that the additional costs of complying with emission regulations do not form too much of a counter-effect. The emission of SO_2 of the sector will drastically reduce, due to the strict regulations in ECAs in particular and in general due to IMO regulations. Current R&D efforts are mainly aimed at realising this reduction, through a mix of measures: using low sulphur content fuel, using scrubbers and by using LNG as a marine fuel. LNG will become an alternative source of fuel for a substantial share of the short sea vessels once a suitable distribution infrastructure is set up. Experts estimate that this may take at least 5 to 10 years.

External drivers affecting the SSS sub-function are:

- Fuel price increases will lead to pressures on the sub-function;
- The European Single Market will contribute to further exports and demand for short-sea shipping;
- Trade with Neighbourhood countries – growth in Turkey, Russia, Ukraine and North Africa will spur the demand for short-sea shipping;
- Congestion of road transport will lead to reduced competitiveness of this alternative (while expectations for rail and inland waterways remain modest).

The sector’s response capacity is characterised by diversity in capacity to respond; larger players will be able to invest and adjust faster than small operators. Levels of technological adjustments are low. Price competition drives an increase in ship size.

1 State of Play

1.1 Description and value chain

1.1.1 Definition and demarcation

Short sea shipping in this report is defined as: intra-European maritime shipping. Short sea shipping forms an important means of transport within the European transport system. It fulfils several functions:

- It caters to the transport needs of European economies by providing maritime point-to-point transport of all kinds of commodities;
- It provides the maritime link that connects the European road network across the seas, in the form of Ro-Ro transport;
- It serves as feeder transport distributing container flows from the major intercontinental hubs to smaller ports, or vice versa.

The definition of short sea transport chosen in this report excludes feeder and Ro-Ro connections with European neighbouring countries, such as those found in the Mediterranean and Black Sea. In the shipping industry, these are generally defined as short sea shipping. However, Eurostat statistics do not include these links in their figures for intra-European shipping.

The definition also excludes passenger ferry services, though there is no strict distinction possible between Ro-Ro services and ferry passenger services. This report includes all services primarily aimed at Ro-Ro freight, though often these services also (to a limited extent) cater to passengers and their vehicles. In practice, there is a whole palette of ferry/Ro-Ro services in between the extremes of a pure cargo Ro-Ro service and a pure passenger ferry service.

In the first two functions mentioned above, short sea shipping often functions as an alternative transport modality to road transport. This has been part of EC policy since the early nineties, when the EC started promoting short sea shipping as a way to reduce congestion on roads and to reduce emissions from transport. It should also be noted that container feeder transport is often combined with container point-to-point transport.

A different way to make a subdivision of shipping services in the sector is as follows:

- Liner shipping, with fixed sailing schedules and fixed itineraries. This mostly concerns container (either point-to-point or feeder services) and Ro-Ro services.
- Shipping with fixed contracts, mainly for dry bulk (ores, coal, cereals) or liquid bulk (crude oil, LNG, fuels, base chemicals), often under long term contracts (most commonly 5 to 10 years) for the transport of bulk commodities between two ports. In short sea shipping this is only done with small to medium-sized vessels, whereas large vessels are dominant in this segment in intercontinental shipping.
- Tramp shipping: spot contracts for single voyages, usually medium-sized vessels (handysize and panamax), which can call at all or nearly all seaports.

1.1.2 Value chain / economic sectors

Shipping itself is a service to many other functions, often linking various stages of a production process that are at different physical locations or providing part of the distribution chain of finished goods. The short sea shipping value chain consists of:

- Shipbuilding and marine equipment – delivering the transport equipment

- Operation of ships – shipping freight
- Port services and logistics – operating terminals, handling cargoes, storage, VAL, port management
- Other maritime services (bunkering, ship repair, pilotage, etc.)
- Maritime works – constructing ports, maintaining access channels

1.2 Description of the current structures

1.2.1 Economic performance

Intra-EU and domestic shipping accounted for respectively 25% and 11% of all EU maritime transport in 2009[1]. This equals 978 mln ton of freight; down from 1,088 mln ton in 2008. This downward trend is a result of the economic crisis that started in Autumn 2008, which hit the shipping sector hard.

Eurostat also publishes figures specific for SSS, using a definition that includes intra-EU and domestic shipping as well as all short distance maritime transport involving EU neighboring states bur with either origin or destination in a member state. The total volume of SSS in 2009 according to this definition was 1,685 million tons of freight, implying that just under 600 million tons of freight concerned SSS between a member state and a non-member state. The division per basin is as in

Table 1: Division of European SSS over the sea basins (million tonnes)

Basin	Percentage	Volume
Baltic Sea	19.6%	330
North Sea	26.4%	445
Atlantic Ocean	13.7%	231
Mediterranean Sea	29.7%	500
Black Sea	6.4%	108
Others	4.3%	73
Total	**100.0%**	1,685

Source: Eurostat

A differentiation in volumes to various types of shipping is given in Table 2. Nearly half of the total is liquid bulk shipping; the second largest is dry bulk shipping. Ro-Ro and container shipping each have a similar share at around 12%.

Table 2: Division of European SSS into types of shipping (million tonnes)

Type of shipping	Percentage	Volume
Liquid bulk	49.7%	837
Dry bulk	20.1%	339
Ro-Ro	12.1%	204
Container	11.7%	197
Other	6.4%	108
Total	**100.0%**	1,685

Source: Eurostat

For employment and value added, a differentiation for short sea shipping and other forms of shipping cannot be made. Here, only statements referring to the total shipping function (deep sea and short sea shipping) can be made:

[1] Source: Eurostat

- Total shipping function employs appr. 2.5 mln FTE (Eurostat, 2007 data), 84% of which in ports. (Ecorys, 2009). The employment on board ships is relatively small compared to the whole maritime sector. Moreover, a large share of crew positions is no longer fulfilled by Europeans;
- Total shipping function value added is appr. 188 bn EUR (Eurostat, 2007 data), 82% of which in port services.

1.2.2 Main sub-function players

The short sea shipping sector is relatively fragmented; however there are a few main players to be mentioned. There are differences between the types of shipping.

Bulk shipping

The bulk SSS market accounts for nearly 70% of the total (50% liquid bulk and 20% dry bulk). Liquid bulk transport concerns transport of crude oil, oil products and chemicals, whereas dry bulk relates to commodities such as coal, iron ore and other ores and various types of cereals. This market segment is quite fragmented, with a lot of smaller players active on the market. In this segment, a fair share of spot contracts is found.

Ro-Ro shipping

The Ro-Ro shipping market is dominated by a few large players, often with a specific geographical focus. Ro-Ro shipping is also very much integrated with ferry traffic: many Ro-Ro vessels are ro-pax vessels that cater to Ro-Ro freight as well as to passengers and their vehicles. Some companies are in principle Ro-Ro operators that also cater to passengers, such as DFDS Seaways, Finnlines (owned by Grimaldi Group), Grimaldi Lines and Grandi Navi Veloci. Vice versa, a number of companies aimed at passenger ferry transport also cater to trucks and Ro-Ro, examples are Stena Lines and P&O Ferries. Many Ro-Ro players are also active as logistics service provider and/or intermodal operator. Cobelfret Ro-Ro is an example of a logistics service provider that integrated into Ro-Ro services.

Container shipping

A distinction can be made between container feeder shipping and point-to-point container transport. The first is directly linked to the main intercontinental container lines as it forms part of the global container supply chains, the second concerns intra-European container transport. In practice, these two container flows are often combined. Feeder ships usually also cater to the point-to-point container transport market to create economies of scale. Some of the intercontinental container carriers operate their own feeder lines, such as Maersk, CMA-CGM and MSC. Other companies are purely European short sea container (feeder and/or point-to-point) operators, such as: Unifeeder, Seago (a recently started joint venture of Maersk and Safmarine) and United Feeder Services. Some container operators have also integrated into hinterland transport and logistics services, though less so than Ro-Ro operators.

Other shipping

This segment mainly consists of general cargo shipping, which includes cargo on pallets or in big bags and breakbulk cargo such as timber and steel products. It also includes project cargo. This segment is also quite fragmented with many small players active in the market.

Other market players

Besides the carriers, there are many parties active in the shipping market providing services to the carriers. Examples are marine terminal operators, financiers (banks), insurance companies, shipbuilders and repairers, classification societies.

Market domination

A firm statement on who dominates the market cannot be made. In the first place, it depends on the type of shipping. In bulk shipping, often the producers or the users of the commodity dominate the market, such as oil companies or chemical firms. They tend to have invested large sums in their refineries and chemical complexes and wish to keep a firm control of the transport of the inputs or outputs of these production facilities. In the bulk markets, the users/producers are quite concentrated and the maritime transport market is quite fragmented.

In Ro-Ro and container transport, several large carriers dominate the market, especially the ones that integrated into hinterland transport and logistics services. Here, the reverse can be seen as in bulk shipping: the transport market is relatively concentrated whereas the transport users are quite fragmented. It should however be mentioned that market domination means that these companies adopt a role of transport chain director, rather than dictate prices. Competition between the maritime transport companies is firm, keeping prices down.

1.3 Regulatory environment

There are no specific regulations for short sea shipping. Short sea shipping operations need to be compliant with maritime regulations, both at worldwide level and at EU level.

The ownership and management chain surrounding any ship can embrace many countries and ships spend their economic life moving between different jurisdictions, often far from the country of registry. For that reason there is a need for international standards to regulate shipping - which can be adopted and accepted by all. An important role in this plays the International Maritime Organization (IMO) who was adopted in Geneva in 1948. The main task of IMO has been to develop and maintain a comprehensive regulatory framework for shipping including safety, environmental concerns like NO_x emissions, legal matters, technical co-operation, maritime security and the efficiency of shipping.

The most relevant regulations regarding short sea shipping are listed below:

- Port State Control regulations requiring ships to meet international safety, security and environmental standards and involving inspections in ports of call. The rules are approved through the Paris MoU on Port State Control.
- IMO regulations on navigation and ship safety and environment, brought together in the SOLAS and MARPOL maritime legislative frameworks.
- EC Directive 2000/59 on port reception facilities, with the aim of substantially reducing discharges of ship-generated waste and cargo residues into the sea.
- New EU legislation that came into effect on 1 January 2010 pertains to the EU Sulphur Directive 2005/33/EC, which defines limits on the sulphur content of marine fuels.
- Regulation (EC) No 725/2004 on enhancing ship and port facility security and Directive 2005/65/EC which complements the security measures introduced by Regulation (EC) No 725/2004.

1.4 Strengths and weaknesses of short sea shipping (SSS)

The strengths of SSS in a global perspective are the following:

- Shipping has the lowest unit cost of all transport modes and is therefore the best option for the transport of freight over large distances.
- Shipping has a relatively low environmental footprint per tonkilometre compared to other modes of transport.

- The European short sea shipping sector is not very vulnerable to competition from other parts of the world: maritime cabotage is only allowed to Community registered shipping companies.
- Europe still has a technology based advantage in the sector of marine equipment suppliers compared to other parts of the world.

The weaknesses of SSS in a global perspective comprise:

- About 30 to 40% of the operational costs of short sea shipping consists of fuel costs. This implies the sector is vulnerable to variations in the price of fossil fuels.
- The sector is dependent on the economic climate. The decreases in shipping volumes as a result of the 2008 crisis demonstrate this.
- Shipbuilders face intense competition from mainly Far Eastern competitors that are able to produce at lower costs. In fact only specialised shipbuilding still takes place in Europe.
- Asian marine equipment suppliers are catching up which threatens the position of the European marine equipment industry.

Constraints:

- Lack of adequate infrastructure can in some regions be a constraint to further growth of the shipping sector. This mainly concerns maritime infrastructure in secondary ports.
- Increasingly, connections to the hinterland transport network are becoming a bottleneck, though more so to hub ports receiving large vessels and larger volumes, which almost by definition are related to intercontinental shipping.

2 Research and technology

In the SSS sector, the focus of research and technology developments is on the reduction of emissions (section 2.1) and on increasing the fuel efficiency of ships (section 2.2).

2.1 Reduction of sulphur and other emissions

The emissions of harmful substances by transport are a major concern. In maritime transport, this concerns in particular the emissions of SO_2 as ships use heavy fuel oil which has a relatively high sulphur content. Recent developments in technology therefore concentrate on the reduction of sulphur emissions.

IMO MARPOL Annex VI sets limits on sulphur oxide (SOx) and nitrogen oxide (NOx) emissions by ships and prohibits deliberate emissions of ozone depleting substances. The IMO emission standards apply to ships over 400 GT and engines over 130kW. The revised Annex VI allows for Emission Control Areas (ECAs) to be designated for SOx and particulate matter, or NOx, or all three types of emissions from ships. In these ECAs a stricter emission standard is enforceable. The Baltic Sea Area and the North Sea were adopted as SOx Emission Control Area (SECA) in July 2005. Here, stricter emission standards apply. As per 1 July 2010, the maximum sulphur content of fuel to be used in these two areas is 1.0%, to be further reduced to 0.1% per 1 January 2015.

According to Det Norske Veritas (DNV), there are three main solutions to comply:

1. the use of low sulphur fuel;
2. the use of scrubbers to clean exhaust gases from standard marine fuel oils (under certain conditions IMO regulations allow the use of high sulphur fuel oil if scrubbers are used);
3. the use of LNG as marine fuel.

2.1.1 Low sulphur fuel

Standard heavy fuel oil is a residual oil from the refining process. It typically has a sulphur (SO_2) content of 3.5%-4.5%. Low sulphur fuels may consist of specially refined residual oils, of ultra-low sulphur diesel oil designed for motor vehicles or trains, or of bio-fuels. Refinery produced ultra-low sulphur fuel may have a sulphur content as low as 0.0015%; bio-diesel naturally contains zero sulphur content[2]. The following table shows IMO-regulations for the maximum sulphur content of marine fuel oil.

Table 3: Overview of IMO regulations on maximum sulphur content and dates of validity

Dates	General requirements	Requirements in ECA
Prior to 1 July 2010		1.5%
After 1 July 2010		1.0%
Prior to 1 January 2012	4.5%	
After 1 January 2012	3.5%	
After 1 January 2015		0.1%
After 1 January 2020	0.5%	

Source: IMO resolution MEPC.176(58)

[2] See: http://www.drew-marine.com/fm_lowsulfur_solutions.html

Low sulphur fuel oil is in fact an oil distillate, rather than a residual such as standard heavy fuel oil. This additional processing will add to the cost of the fuel. Currently, the price difference in Rotterdam between standard intermediate fuel oil and 1% sulphur content fuel oil is 35.5 USD per metric ton; the difference with 0.1% sulphur content fuel oil is 323.5 USD per metric ton[3]. With about 30%-40% of the costs of shipping related to fuel consumption, this makes a difference.

Apart from the price difference due to additional processing, the shipping industry fears that worldwide refining capacity will not be sufficient to foresee in the increased demand for oil distillates, resulting in upward pressure on fuel prices. One of the interviewees also raised the issue of the residual fuels: what will happen to these if they are no longer used as shipping fuels? Will the residuals become a waste of the refining process?

There are also some operational challenges involved with low sulphur fuel oils, such as compatibility, lubricity and biological contamination. These can have an impact on engine performance and wear. However, these operational challenges can be overcome and generally do not form a barrier to the use of low sulphur content fuels.

2.1.2 Scrubbers

Scrubbing is a generic term for techniques that clean exhaust gases. In maritime shipping, scrubbers can be applied to extract SO_2, NO_x and PM particles from fuel exhausts. Trials by members of the Exhaust Gas Cleaning Systems Association (EGCSA) show that currently available systems can reach reductions in particulate matter of up to 80%[4], whereas the organisation is confident that further development can substantially improve this figure.

The advantage of using scrubbers is that the shipping industry can continue to use the “dirty” residual oils, which is cheaper than using distillates with low sulphur contents. Under certain conditions, IMO regulations allow the use of high sulphur combined with the use of scrubbers. Trials have shown that scrubbers can effectively be applied to very large modern container vessels. The disadvantage is that retrofitting is not cheap; retrofitting scrubbers on an average sized vessel such as an Aframax tanker[5] would be around 1 million USD.

2.1.3 LNG fuelled ships

LNG is an alternative to heavy fuel oil for ship propulsion. The technology is existing; the first LNG fuelled vessel was a ferry in Norway, the Glutra. It was a government funded prototype testing the use of LNG as fuel. Based on the experience of building and running the Glutra, DNV has written regulations for the use of ferries powered by LNG.

Since the first trials, several Norwegian ferries have switched to LNG. The current world fleet of LNG fuelled vessels is 22 in total6, of which 21 operate in Norway. The order books contain another 17 ships scheduled for delivery in 2011 to 2013. The drive for switching to natural gas engines comes from the establishment of the Emission Control Area for the Baltic Sea and parts of The North Sea. By utilising natural gas, SO_x, NO_x and particulate matter emissions are reduced by up to 80%, while CO_2 can be reduced by between 15 % and 25 % compared to regular marine diesel (MDO) or heavy fuel oil (HFO).

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[3] Source: Bunkerworld, prices Rotterdam, 1 August 2011
[4] Bruckner-Menchelli, N., Scrubbers versus distillates, Bunkerworld May/June 2009, pg24
[5] Size class of between 80,000 dwt and 120,000 dwt
[6] As per February 2011, see Blikolm, L.P. A review of the World fleet of LNG fuelled ships, blog post on blogs.dnv.com

There are some disadvantages to using LNG as marine fuel. The first is that LNG requires two-and-a-half times as much tank space as traditional fuel oil tanks, making it unsuitable for covering large distances. This may of course be more of an issue to intercontinental shipping than to short sea shipping. The second issue is the lack of infrastructure for bunkering. A dense network is needed as the distances to be covered on LNG generally will be shorter than for traditionally fuelled ships. There are also strict regulations for LNG terminals, for instance regarding the minimal distance from populated areas and regarding limitations on marine traffic in the vicinity of LNG terminals.

2.1.4 *Which of the three solutions will prevail?*

As discussed above, each of the three solutions has its advantages and disadvantages. Generally, it is expected that the solution will ultimately be sought in the use of low sulphur fuel distillates, perhaps in combination with scrubbing techniques to reduce particle matter emissions even further. In the short to medium term, considering the possible lack of capacity to provide a sufficient supply of low sulphur distillates, scrubbing may be a good option to reduce the emissions from a continued use of residuals, especially as retrofitting on older vessels.

For short sea shipping applications, LNG can offer a good alternative to marine fuel oil. Interviewees consider that another 5 to 10 years may be needed to set up a suitable distribution infrastructure.

2.2 Other technological developments

Other technological developments also mostly aim at reducing the fossil fuel consumption, perhaps not driven by regulations such as the sulphur content reduction, but rather by attempts of the shipping industry to reduce unit costs.

2.2.1 *Increase in scale*

The ships used for SSS are expected to continue to increase in size. The shipping industry has been characterised by an increase in scale in search of lower unit costs for decades. Economies of scale are reached through the effect that the costs of operating a vessel do not rise proportionally to the size of a vessel. An average intercontinental container ship of the seventies is now the average size of a container feeder ship. In short sea shipping, this increase in scale is seen just as much as in intercontinental shipping.

Unit costs have also been reduced by improvements in engine performance and advances in ship design. It may be expected that this will continue along with the progress of technological developments.

2.2.2 *Alternative sources of energy*

Attempts to reduce the dependency on fossil fuel or to reduce emissions have resulted in a number of technological innovations or developments. Examples are:

- The provision of electrical power from shore based power outlets while ships are in port (suggested for implementation by regulations in the InnoSuTra deliverables[7]).. This means vessels no longer need to keep their auxiliary engines running to generate electrical power while berthed in ports. The advantage is that there is a reduction from ship's emissions in often

[7] Innovation in Surface Transport (InnoSuTra) is an EU 7th framework programma project, see www.innosutra.eu

densely populated port areas. Criticasters however claim that only 20% of a ship's in port emissions are produced while berthed and that 80% is produced whilst manoeuvring the vessel inside the port area.

- The use of kite-shaped sails. Several tests were done a few years ago, showing that kite-shaped sails may reduce the fuel consumption of oceangoing vessels by 20% to 30%[8]. The use of kites is more suitable for intercontinental traffic that maintains a similar course for a prolonged period, rather than for short sea shipping.
- The application of solar panels on the ships deck. Solar power is not suitable for sip propulsion, but can be used to generate electrical power for thrusters, hydraulic and steering gear. NYK owns the Auriga Leader, a car carrier equipped with solar panels that provide 10% of the ship's electrical power requirement[9]. The disadvantage of solar panels is the amount of deck space needed. Car carriers or tankers may have sufficient spare deck space, but container ships will have hardly any spare deck space at all.

2.2.3 Research & Technology mining patterns

No Research & Technology mining patterns have been identified for this subfunction.

[8] See for instance: http://www.treehugger.com/files/2008/03/beluga-skysails-cargo-ship-kites.php
[9] See for instance: http://inhabitat.com/auriga-leader-cargo-ship-gets-power-from-solar-panels/

3 Future developments

3.1 External drivers and key factors affecting the performance of the cluster

This section lists several external drivers, defined as developments external to the SSS sector that will influence the sector.

3.1.1 External drivers

Fuel price increases

Expected increases of the fuel price will have great impact on the current structure of the sector, as a large share of the costs consists of fuel costs. Larger companies may be in a better position to take counteracting measures than SMEs, as these may lack the size and volume to finance such measures. Especially on shorter distances short sea shipping competes with land modes road and rail. Fuel price increases could in principle imply a shift from road/rail to the more energy efficient shortsea shipping.

European Single Market

Although the current crisis is spreading rumours of weaknesses for the EU single market, it is likely that the current process of integration increases and accelerates in the near future. This is mainly due to the greater role of EU central policy, greater need for internal market efficiency and increasing shifts in export patterns that might lead to increased internal trade.

Trade with Neighbourhood Countries

EU trade might shift towards southern and eastern neighbour countries, due to the fact that these countries are rich in natural resources and are facing a near-future of economic growth. Russia, Turkey, Ukraine and generally Neighbour Countries in the Black sea and Southern Mediterranean are likely to increase their role as EU economic partner. They might therefore trigger greater exchange through sea-transport connecting those areas, with a consequent potential boost for short-sea shipping in the Baltic, Mediterranean and Black Sea. Trade with the Northern African countries will have decreased as a result of the Arab Spring developments, however the longer term effect may be an increase of trade once the dust has settled and the countries have returned to political stability. The pace with which this will be realised is however uncertain still.

Congestion of road transport

Although still the primary means of intra-EU transport, road transport is likely to face increased problems with congestion and delays. The sector also faces an increasing shortage of qualified employees, more so than the shipping sector that has found a partial solution by employing seamen from outside the EU. A third trend is the increase in road charges, such as the German Maut system for trucks over 12 tons applicable since January 2005, which is likely to translate into increasing costs for road transport. These trends might have a direct effect in the future on the (price-) competitiveness of short-sea compared to road transport.

3.2 Assessment of response capacity and commercialisation potential

Price competition drives increase in ship size

Price competition is driving ship size increase in search of lower unit costs. This is very obvious in intercontinental shipping, but is taking place in short sea shipping just as well. A side effect is that lower unit costs are largely realised by reducing fuel consumption per unit, which helps reducing emissions from shipping.

Diversity amongst players in reaching adequate economy of scale (and leading role of shippers)
The market is highly fragmented and few big players are confronted with several SMEs and micro-enterprises spread across ports in EU coastal regions. Consequently, few big players are well-structured to capture the value of and build on large economy of scale, whilst the majority of Small- and Micro-Enterprises have low if any capacity to succeed in a competitive market. Moreover, large and powerful shippers can easily exercise power pressure and control over such small- and micro-enterprises, with a consequent key role in shaping the market.

Diversity amongst the capacity of terminal operators and low level of overall organisation
Similarly to the ship operators, terminal operators are largely small and lacking capacity, moreover, due to the high fragmentation and dispersion of the operators across EU maritime regions, the level of organisation amongst operators across the EU is low and not much effective, with few large operators leading the sector and many small-micro ones left alone to cope with an emerging demand for control, security and professionalism.

Increased interaction between regional ports
In many port regions, multiple seaports are located within close vicinity of each other. Examples are the port of Rotterdam, with regional ports such as Dordrecht and Moerdijk, or the port of Le Havre, linked to Rouen and Caen. While at a higher level Le Havre and Rotterdam compete, at regional level the ports cooperate, by using inter-port services, sharing facilities or by specialising as a means to optimise land use. This implies synergies strengthening the region as a whole, with positive employment and competitiveness impacts. Policy makers play their role by taking measures to support these.[10]

Low capacity for technological adjustment
From a technological point of view, the short sea shipping sector is in the condition to respond to the structural changes concerning sulphur content of fuel and emissions needed to achieve EU targets, as there are several options currently available for compliance. Nonetheless, it is unlikely that such a fragmented and SMEs-intense sector can autonomously accelerate the path of adjustments needed to achieve the expected EU goals on carbon emissions. Commercially speaking, and particularly for small- and medium-enterprises, there is one major concern within the sector: how will the increased costs influence the competitive position of the sector? How can the sector accelerate the mitigation path and maintain its competitiveness?

It is unclear to what extent the additional costs of mitigation measures to lower emission regulations can be passed on to the clients. Interviewees also pointed out the risk of a reverse modal shift: if short sea shipping costs increase too much, then cargo-owners might revert to road transport as an alternative. This would be a development contrary to the modal shift from road to short sea that was realised in the past 20 years of EU policy in this field.

Poor developments in maritime traffic monitoring
There is a current lack in the development of a European-wide maritime traffic monitoring system: it may help increasing efficiency in ports, through a better distribution of information. The idea is that ships are tracked during their journey through European waters, along with all the information available on cargo and its destination. This information can be shared with the relevant

[10] OECD, 2011, The Competitiveness of Global Port-Cities: The Case of the Seine Axis (Le Havre, Rouen, Paris, Caen) – France

stakeholders in ports for planning purposes, thus making the logistic process more efficient. Nonetheless, it currently appears impossible for the sector, due to proliferation of small players, to promote joint initiatives aimed at gathering data and providing adequate business intelligence.

Equipment manufacturing within EU (although increasingly challenged by Asian competition)
Until recently, a factor of strength for the sector was the leading position of EU companies in the manufacturing of marine equipment needed for short-sea shipping. Nonetheless, fierce competition is emerging from global regions and particularly China and Asia. Although Europe is still holding the leadership in this area, this is an advantage that is bound do decrease through time.

3.3 Most likely future developments

Sector depending on EU growth (although growing at a faster pace than the latter)
Trade being connected to global economic growth, the sector is highly dependant on the economic growth of the EU. Nonetheless, being a specific component of overall growth, trade tend to grow at a faster pace than overall EU growth and might benefit from moderate EU overall growth, as well as an increased EU internal market integration.

Increased disadvantages for road transports boosting modal shift
A key driver for future growth of the sector is the (relative) shift from road to short-sea transports. As price is the key factor for modal shifting of shipping company from road to short-sea, increasing congestion and growing concerns and regulation over CO_2 emission in road transport might rapidly increase the competitiveness of short-sea shipping over road transport in the short-mid future.

Potential for rapid reduction of emissions
As “green technology” is already largely available for short-sea shipping, an increase of potential volumes for the sector might provide direct economic incentives for structural changes through the adoption of green technologies in the short terms. Such market dynamics might therefore trigger a rapid acceleration in the reduction of emission within the sector.

The most likely dynamics in the future development of the sector are therefore as follows:

- The transported volumes of cargo will generally develop along with economic development. Additional growth of volume may be realised by stimulating modal shift, provided that the additional costs of complying with emission regulations do not form too much of a countereffect.
- The emission of SO_2 of the sector will drastically reduce, due to the strict regulations in ECAs in particular and in general due to the IMO regulations. This will be realised through a mix of measures: using low sulphur content fuel, using scrubbers and by using LNG as a marine fuel.
- It is not yet clear if the refining industry will be able to respond in time with sufficient capacity to satisfy the demand for low sulphur fuels and it is not clear what price developments will take place.
- It may be expected that LNG will become an alternative source of fuel for a substantial share of the short sea vessels once a suitable distribution infrastructure is set up. Experts estimate that this may take at least 5 to 10 years.
- Other emissions, such as NOx, CO_2 and PM may also be expected to be reduced, in general as a result of the ongoing scale increase leading to lower fuel consumption per tonkilometre, in particular as a result of a more substantial application of LNG as marine fuel.

- Marine traffic control will no longer be restricted to ports and designated areas, but a European-wide network of maritime traffic control centres will cover the entire European waters. This will increase traffic safety, environmental security and will help increasing the efficiency of logistics in ports.

3.3.1 Constraints and framework conditions

Infrastructure: lack of capacity in secondary ports

Although in the main European ports the maritime infrastructure is well developed, in most of secondary ports across EU maritime regions a lack of port capacity may form a constraint to further growth. Many ports, especially the main ports, face an increasing pressure on their hinterland transport sector. A lack of sufficient hinterland links may constrain the flows of cargo between ports and hinterland, which might provide a barrier in the development of a fully integrated EU short-sea network.

Developments in maritime traffic monitoring

In the field of security, a major change is currently taking shape. EMSA is developing a maritime traffic control system based on satellite imaging, which will allow maritime traffic control centres to follow the moves of each ship within European waters. Currently, maritime traffic control does not extend beyond port boundaries and a few very busy areas, such as the English Channel. Whatever a ship does outside these boundaries cannot be monitored, at least not continuously. There are patrols with aircraft aimed at detecting illegal discharges at open sea, but there is no continuous monitoring of vessel manoeuvres and discharges.

With a traffic control system based on real time satellite imaging, maritime traffic control will become much like air traffic control: there is continuous information on location and movement of the ship. This mandatory reporting breaks with the longstanding principle of free maritime passage and may therefore be called a major change. It is also possible that mandatory routing will be introduced. Such intensified form of traffic control is expected to result in a higher traffic safety, more environmental security and more efficient use of ports.

3.4 Impacts, synergies and tensions

3.4.1 Impacts

The following table gives an overview of the main impacts for short sea shipping. Based on the desk research and the interviews the most important synergies and tensions are:

- Growing economic and employment potentials, particularly in those basins (Baltic, Mediterranean, Black Sea) that can take greater advantage from the link with deep-sea shipping and hubs with growing noon-EU countries (i.e. Russia, Turkey, etc.)
- Generally potential for increased efficiency in energy and environmental impacts in those areas with a stringent ECA regulation (North Sea, Baltic) that requires quick adaptation CO2-neutral technological for the sector. Whilst in other basins negative impacts might continue and increase.
- Short-sea shipping has potentially negative impact for natural environment and aquatic life, in the absence of sound regulatory framework and sustainable strategies.

Data for Black Sea though are scarce and estimations are based on suggestions emerging through interviews. It is then difficult to provide any estimation for arctic and outermost sea basins.

Table 4: Impact matrix of the medium-term and longer-term developments

Function	Indicators	Bal-tic	North Sea	Medi-terr.	Black Sea	Atlan-tic	Arc-tic	Outer most
1. Economic impacts	Market share	++	+	+	+	+	?	?
2. Employment impacts	Employment	+	+	-	+	+	?	?
3. Environmental impacts	Natural habitats	-	0	-	-	0	?	?
	Energy consumption	+	+	-	-	+	?	?
	Aquatic life	-	0	-	-	0	?	?

Source: Ecorys on Interviews

++ = Strong positive expected trend

+ = Mild positive expected trend

0 = No relevant change

- = Mild negative expected trend

-- = Strong negative expected trend

? = No clear information/expectations

3.4.2 Synergies and tensions

The following table gives an overview of the synergies and tensions between short-sea shipping and other sub functions. Based on the desk research and the interviews the most important synergies and tensions are mostly amongst the following four categories:

- Sub-functions which are part of short-sea shipping value chain, and increase in performance implies growing demand for this sector (deep-sea shipping and to a certain extent raw materials), or greater appealing due to greater in-land integration (inland waterway transport).
- Sub-function which might be negatively affected by growth is short-sea shipping, but might also benefit due to economies of scale and synergies in transports (coastal tourism and living)
- Sub-function which definitely benefit from short-sea shipping due to consequence in greater development of security infrastructures and systems (monitoring and surveillance)
- Sub-functions that might be negatively affected by growth is short-sea shipping in the absence of sound regulations (nutrition and ecosystem), but might also benefit due to economies of scale and synergies in transports (coastal tourism and living).

Table 5: Short sea shipping: Synergies and tensions

Subfunction	Affected	
Maritime transport and shipbuilding	+	growth market positively affecting shipbuilding sector
Food, nutrition, health and ecosystem services	-	risk of damage to eco-system services due shipping and port activities
Energy and raw materials	-	Synergy is expected in off-shore know-how
	-	spatial conflict with offshore wind farms
Leisure, working and living	++	source of income for local communities
	--	pollution and negative impact from development on natural and living environment (tension with Natura

		2000)
Coastal protection	+	port infrastructure contributing to coastal protection
Maritime monitoring and surveillance	0/+	Shipping is an important user community for tracing

Source: Ecorys on Interviews

++ = *Strong potential positive impact on other subfunctions/sea basins*

+ = *Considerable potential positive impact on other subfunctions*

0 = *Negligible impact on other subfunctions/sea basins*

- = *Considerable potential negative impact on other subfunctions*

-- = *Strong potential negative impact on other subfunctions*

4 Role of policy

4.1 Policy and political relevance

There are three main domains in which governmental policies influence the sector:

1. emission regulations;
2. policies aimed at creating a modal shift towards short sea shipping
3. standards for security and consequent enforcement of rule of law.

Emission regulations

Emission regulations for the shipping sector are decided upon at IMO level. As this requires worldwide consent, the process generally is slower than Brussels would like to see. The ECAs in the Baltic and North Sea are in a sense an accelerated version of stricter emission regulations, though not initiated by the EU. ECAs can be nominated by member states and the EU can endorse the nomination, but IMO decides upon the declaration of ECAs.

Modal shift

Since the early nineties the EU has promoted a modal shift from road to alternative means of transport, one of which is short sea shipping. The result has been a more or less constant share of short sea shipping (at about 40%) in European transport. Major policies aimed at short sea shipping were the Motorways of the Seas concept, which targeted infrastructure, and the Marco Polo programme, which financially supported the initiation of sustainable freight transport, including short sea. A recent example is the Blue Belt project, a pilot with 250 short sea ships aimed at reducing the administrative burden of shipping in order to make it more attractive compared to road transport. Interviewees mentioned that Marco Polo support has encountered issues with competition distortion. There are several cases in which the financial support received by one operator was challenged by another operator, for instance providing a competing service from a nearby port. It is expected that competition issues will increasingly reduce the opportunities of Marco Polo funding.

Security policy

Increasing need for security is also a major area calling for policy intervention, in order to better regulate such a fragmented market and provide clear standard and rules across the EU maritime regions.

At regional level policy influences the cooperation within and between ports, e.g. by developing regional port development strategies, entailing cooperation agreements between port cities, or establishing frameworks for the institutional organisation of ports.

4.2 Domains for EU policy

Emission regulations

Emission regulations for the shipping sector are the domain of IMO. The EU used to be an observer within IMO, but is now increasingly acting as a delegate, raising its voice within the IMO on behalf of the EU27. These apply to the overall shipping sector, but short sea shipping is affected more as many short sea services are within the ECAs in the Baltic and North Sea.

Modal shift

It may be expected that the EU will continue to promote short sea shipping as a more sustainable transport mode, as is also indicated in the White Paper on transport 2011. The White paper 2011 specifically mentions abolition of barriers to short sea shipping. The following box gives an explanation on the FP7 SKEMA project, which aims to set up a knowledge Platform of (EU) project and study outputs in the field of European maritime transport and logistics.

SKEMA

Sustainable Knowledge Platform for the European Maritime and Logistic Industry[11]

(2008 – 2011)

Funding programme: FP7
Project Duration: 36 Months
Total Project Value: €2.3m
EU Grant-Aid: €2.3m
Website: http://www.skematransport.eu/

Coordinator: Athens University of Economics and Business Research Centre (GREECE)

Partners: Nautical Enterprise Ltd, Irish Exporters Association, Dublin Port Company (Ireland); INLECOM Systems Ltd, Sea and Water (UK); Chalmwea tekniska hoegskola AB, Oresund Logistics (Sweden); Portel Servicios telematicos, S.A.Compania Transmediterranea (Spain); Centre for the Development of Transport and Logistics in Europe (Netherlands); Valtion teknillinen tutkimiskesus (Finland); EBOS Technologies Ltd. (Cyprus); Maritime Administration of Latvia (Latvia).

Relevance:
Shortsea shipping is a mature but fragmented sector. The creation of a knowledge platform will help the main stakeholders in collecting and exchanging information.

Project Description:
The SKEMA Knowledge Platform contains a Knowledge Base that is populated by project Studies and outputs from workshops and case studies addressing key challenges for the European maritime transport and logistics industry. The Studies will be constructed to facilitate improved usability and accessibility of valuable results from previous projects, studies & publications.

Results:
- Facilitates the exchange of information amongst stakeholders in the European maritime transport and logistics industry, raises awareness of relevant research (e.g. the platform present easy access to all the main maritime related EU current and past projects).

- Assists in the recognition of obstacles that hinder the implementation of European policies and in proposing and assessing solutions;

- Provides base material that will help in the formulation of advice on various policy initiatives, such as legislation, (including simplification), standardisation, research, networking and co-operation between administrations.

[11] http://www.marine.ie/NR/rdonlyres/CB79A224-4103-48B6-B585-1EB488C5A467/0/FP7_SKEMA.pdf,

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Annex 2 Stakeholder catalogue

Interviewee	Organisation	City/country	Specific theme	Interviewer	Face to face, or telephone
Antonis Michail, Martina Fontanet	ESPO	Brussels, Belgium	SSS - ports	Eric van Drunen	Face-2-face
Alphons Guinier	ECSA	Brussels, Belgium	SSS - shipowners	Eric van Drunen	Face-2-face
Yannick Texier	EMSA	Brussels, Belgium	SSS - safety, security	Eric van Drunen	Tel
Willy de Decker	Shortsea.be	Antwerp, Belgium	SSS – promotion	Eric van Drunen	Face-2-face
Wye Keong Lai	Valletta Gateway Terminals	Valletta, Malta	SSS – port operations, Mediterranean	Eric van Drunen	Face-2-face
Diederik Blom	Samskip	Rotterdam, the Netherlands	SSS – shipping company Baltic/North Sea	Eric van Drunen	Tel
Stijn Effting	Port of Rotterdam	Rotterdam, the Netherlands	SSS – strategic port development	Eric van Drunen	Face-2-face
Glenn Murphy	Irish Maritime Development Organisation	Dublin Ireland	SSS	Matteo Bocci	Tel
John van der Horst	Unifeeder	Rotterdam, the Netherlands	SSS feeder shipping Baltic and North Sea	Marjan van Schijndel	Tel
Paul Kyprianou	Grimaldi lines	Naples, Italy	SSS – Ro-ro operator Mediterranean	Matteo Bocci	Tel

Annex 3 Case studies

Case study: Clean Shipping Network

The Clean Shipping Network was set up in 2007 with the aim to create a tool for large Swedish cargo owners to evaluate the environmental performance of carriers when procuring. The index is based on five major areas: CO2, NOx, SOx, Particulate Matter (PM), water and waste control, chemicals. The scores from 20 questions for the different areas are weighted equally to arrive at an overall score. By now 27 large cargo owners have joined the clean shipping network, including Volvo, IKEA, H&M. recently, the first non-Swedish companies have started joining the network, with Philips

The participating companies have access to the clean shipping index database, enabling them to choose a carrier on the basis of its environmental performance. In the Clean Shipping Index Database all environmental information regarding the submitted ships is available and members of the network can compare the different shipping companies to each other. They can see how well they perform within the different areas of the index, expressed in good, medium or low performance, indicated by green, yellow and red colours respectively. These levels are recommendations set up by the Clean Shipping Project.

For shipping companies, the database provides a new possibility to check how well they perform environmentally compared to other shipping companies. They can then use this information as benchmarking towards their clients and customers.

Case Study: Grimaldi's Proposal for Motorway of the Sea

This case study illustrates in brief the main findings emerging from Grimaldi Group experience in the EU Marco Polo programme within the Motorway of the Sea initiative. Firstly the EU policy is introduced, then the programme is briefly presented and finally some emerging findings and policy suggestions re highlighted.

The Motorways of the Seas

The "Motorways of the Sea" is a concept entering its 10th year of age this year. In fact it officially emerged in the 2001 White Paper "European transport policy for 2010: time to decide"[12] published by the European Commission in September 2001. The document acknowledged the fact that "[…] transport is a key factor in modern economies. But there is a permanent contradiction between society, which demands ever more mobility, and public opinion, which is becoming increasingly intolerant of chronic delays and the poor quality of some transport services" (p. 6). Moreover, it stressed the relevance of some general pre-conditions and challenges, - congestion, sustainability and inter-modal coordination of transport means - to be tackled by a "comprehensive EU policy going beyond EU transport policy" (p. 12).

Within this context, the concept "Motorway of the Sea" was introduced with the aim of promoting an integrated, multi-modal and comprehensive policy aiming at (White Paper, 2001, pp43/46).

- Mapping Europe industrial ports;
- Offering innovative services;

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[12] http://ec.europa.eu/transport/white_paper/documents/doc/lb_com_2001_0370_en.pdf

- Supporting intermodal services.

The Marco Polo Project

Marco Polo is a Programme managed by Directorate General Mobility and Transport. The programme started in 2001 and is now at its second term, with a grant budget of about €450 million for the period 2007-2013. The programme "[…] co-funds direct modal-shift or traffic avoidance projects and projects providing supporting services which enable freight to switch from road to other modes efficiently and profitably"[13].

The five project categories are set out as follows[14]:

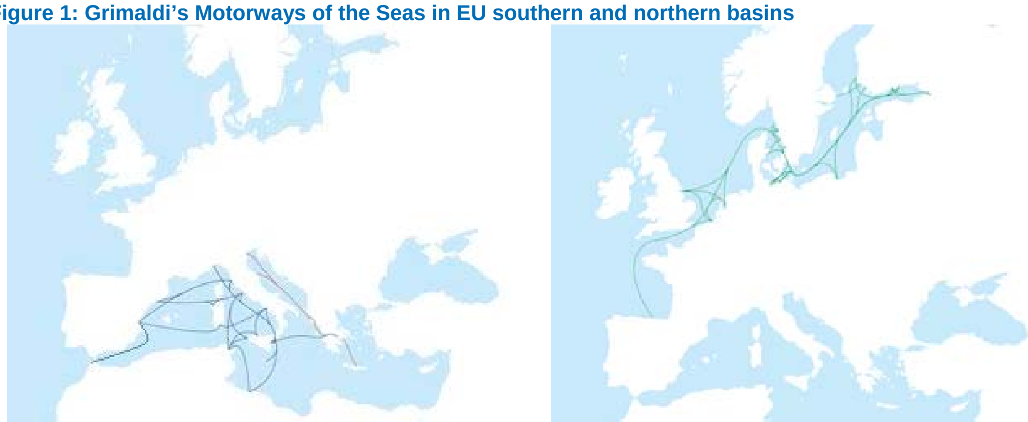
- Modal shifts from road to rail and waterborne systems;
- Catalyst actions which promote modal shift;
- Motorways of the sea between major ports;
- Traffic avoidance;
- Common learning actions.

Marco Polo is intended as user-driven, in the sense that "companies with a project to transfer traffic from road to other modes or to avoid road transport may qualify for a grant, [if the] project has to involve a cross-border route"[15] and be economically as well as ecologically sustainable.

The experience of Grimaldi

Established in 1947, the Grimaldi Group is a "fully integrated multinational logistics Group specialising in maritime transport […] operating in over 25 countries"[16]. The Group has been amongst those private companies pioneering the development of short sea shipping, in relation to the Motorways of the Sea in Europe. The Motorway of the Sea project also included Finnlines and Minoan Lines, therefore bridging the Mediterranean, Northern Europe and the Baltic Seas. Particularly, the project was divided in two: southern (Mediterranean) and northern (North and Baltic).

Figure 1: Grimaldi's Motorways of the Seas in EU southern and northern basins



Source: grimaldi.napoli.it

The short-sea network in the Mediterranean has 12 ships deployed and covers both the East/West and the North/South directions, with most recent developments reportedly established between Italy (including Sicily and Sardinia) and Spain, Tunisia, Libya, Morocco, Malta and Greece. The short-

[13] http://ec.europa.eu/transport/marcopolo/about/index_en.htm
[14] http://ec.europa.eu/transport/marcopolo/about/funding-areas/index_en.htm
[15] http://ec.europa.eu/transport/marcopolo/about/index_en.htm
[16] http://www.grimaldi.napoli.it/en/about_us.html

sea network in the north is provided through Finnlines in the Baltic Sea, and offers regular services between Finland and Germany, Scandinavia, Great Britain, Poland, Belgium and Spain - including weekly service running between Lübeck-Travemünde (Germany) and St. Petersburg (Russia).

Some emerging suggestions

As emerging through interviews held, Grimaldi experience with the Marco Polo Programme was extremely positive and EU support was much appreciated. Nonetheless, at this point in time – and after 10 years since the launch of the initiative – some limitations seemed to be evident. It is now difficult to promote new ports and routes in the more mature basins (and particularly the Mediterranean), whilst issues are now of a very different nature.

In general terms the perception is that of an un-fair competition amongst sea and road transports, due to i) greater costs introduced for sea transport by EU policy and regulations particularly in Northern Europe; ii) excess in financial and custom controls across EU ports if compared with those required for road transports across Europe; iii) unfair possibility of mitigate road transport costs due to fiscal deduction schemes which are not similarly available for sea transports.

Proposals have been presented in a recent assessment of possible developments[17]:

- Introduce European eco-bonus schemes;
- Sustain info mobility across EU basins;
- Promote vessel efficiency, environmental sustainability and productivity.

The Italian experience, in introducing economic incentives to make an incentive for the transfer of trucks from land to sea, is praised. Furthermore, a role for EU policy is envisaged to facilitate and regulate the exchange of information between vessels and port operators, authorities, custom, terminals, passengers. Finally, it is suggested that the EU should sustain and facilitate technological development through adaptation measures for LNG across the whole supply-chain in the Mediterranean, in order to have diffusion of LNG in short-sea vessels. Also, EU support is welcome in terms of research and innovation, to design of new vessels where larger quantities can be transported with lower energy and fuel consumption, therefore making motorways of the sea across the EU even more environmental friendly[18].

[17] http://tentea.ec.europa.eu/download/MoS/events/genova2011/day2/9_grimaldi.pdf

[18] http://tentea.ec.europa.eu/download/MoS/events/genova2011/day2/9_grimaldi.pdf

Eco-bonus Scheme in Italy[19]

Ecobonus is a national incentive, introduced in 2002 (L.365/2002) to support the road haulage firms to shift more and more goods amounts from the road to sea freight. To this purpose the 2008 Financial Law allocated 77 mln € a year for three year period 2007-2009. Beyond the financial support to the operators there are other measures addressed to promote the associations of small enterprises to use the maritime courses, training activities and the purchase of hardware and software to optimize the security.

The 31 January 2007 <transport ministry Act has identified 28 sea routes (8 international) that could enjoy ecobonus. Beneficiaries are contractors truck companies, associated also each other or with sea operators working in Italy making at least 80 annual trips along the same route. The reimbursement can not exceed a maximum of 30% of the fee of every connection. In 2008 Transport Ministry has allocated a total financing of 231 Million distributed in three years. To obtain funds operator has to fill a specific form and to submit to Ministry within January.

Company must commit itself to maintain the same number of trips and the same quantity of goods using combines road-sea transport for three years period following the year in which it has requested incentive.

Source: Analysis of euromed governance framework (2009), p. 8

[19] http://www.medgov.net/sites/default/files/thematic_report_transport%5B1%5D.pdf

Annex 4 Table of cross-links and synergies

Function affected	Sub-function Affected	General	Baltic	North Sea	Mediter-ranean	Black Sea	Atlantic	Arctic	Outermost	Remarks
1. Maritime transport and shipbuilding	1.1 Deepsea shipping	++	0	++	++	+	+	0	0	Deepsea generates freight and is part of value chain
	1.2 Shortsea shipping (incl. RoRo)									
	1.3 Passenger ferry services	+	++	++	+	+	+	0	0	Combined cargo/passenger (e.g. RoRo) increases feasibility of lines
	1.4 Inland waterway transport.	+	0	++	0	++	+	0	0	Inland waterway is part of the value chain
2. Food, nutrition, health and eco-system services	2.1 Catching fish for human consumption	0	0	0	0	0	0	0	0	
	2.2 Catching fish for animal feeding	0	0	0	0	0	0	0	0	
	2.3 Growing aquatic products	0	0	0	0	0	0	0	0	May in some cases compete with port space, but this effect is limited
	2.4 High value use of marine resources (health, cosmetics, well-being, etc.)	0	0	0	0	0	0	0	0	
	2.5 Agriculture on saline	0	0	0	0	0	0	0	0	

Function affected	Sub-function	General	Baltic	North Sea	Mediterranean	Black Sea	Atlantic	Arctic	Outermost	Remarks
	Affected soils									
3. Energy and raw materials	3.1 Oil, gas and methane hydrates	+	+	+	+	+	+	+	+	Synergy is expected in off-shore know-how
	3.2 Offshore wind energy	+	+	+	+	+	+	+	+	Synergy is expected in off-shore know-how.
	3.3 Marine renewables (wave, tidal, OTEC, thermal, biofuels, etc.)	na	na	na	na	na	na	na	na	
	3.4 Carbon capture and storage	0	0	0	0	0	0	0	0	
	3.5 Aggregates mining (sand, gravel, etc.)	+ / -	0	+ / -	0	0	+ /-	0	0	Dredging helps to deepen water channels. Negative influence in competition for space.
	3.6 Mineral raw materials	+	0	+	0	0	+	0	0	Combined use of ships
	3.7 Securing fresh water supply (desalination)	0	0	0	0	0	0	0	0	
4. Leisure, working and living	4.1 Coastline tourism	+	+	+	+	0	+	0	+	Shortsea can provide synergies for tourism services and stimulate demand
	4.2 Yachting and marinas	0	0	0	0	0	0	0	0	
	4.3 Cruise including	0	0	0	0	0	0	0	0	

Function affected	Sub-function Affected	General	Baltic	North Sea	Mediter-ranean	Black Sea	Atlantic	Arctic	Outermost	Remarks
	port cities									
	4.4 Working	+	0	+	+	0	+	+	+	Expected jobs in and around ports
	4.5 Living	0	0	0	0	0	0	0	0	
5. Coastal protection	5.1 Protection against flooding and erosion	+	+	+	+	+	+	0	+	Ports function as coastal protection mechanisms in some cases
	5.2 Preventing salt water intrusion and water quality protection	0	0	0	0	0	0	0	0	
	5.3 Protection of habitats	-	-	-	-	-	-	-	-	Coastal areas are often sensitive areas. Ports may therefore compete with habitats
6. Maritime monitoring and surveillance	6.1 Traceability and security of goods supply chains	+	+	+	+	+	+	+	+	Shipping is an important user community for tracing
	6.2 Prevent and protect against illegal movement of people and goods	+	+	+	+	+	+	+	+	Shipping is an important user community for tracing
	6.3 Environmental monitoring	0	0	0	0	0	0	0	0	

Explanation:

++ = Strong positive impact on other subfunctions/sea basins expected

+ = Considerable positive impact on other subfunctions expected

0 = Negligible impact on other subfunctions/sea basins expected

- = Considerable negative impact on other subfunctions expected

-- = Strong negative impact on other subfunctions expected

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