Short Sea Shipping

1. Introduction

1.1 Purpose

The idea of promoting short sea shipping (SSS) aims at achieving a more sustainable transport network, where least damaging transport modes have a role to play. SSS statistics concerning safety are relatively good when compared with other means of transport.[1] It is claimed that the development of SSS is crucial to enhance land-sea intermodality, thus pursuing (i) environmental benefits since it reduces pollution levels and road transport accidents and (ii) economic benefits; within this context SSS reduces transport networks congestion levels, reduces investments in transport infrastructure and increases port hinterlands' competitiveness the international markets.[2]

SSS has been growing significantly over the past 40 years mainly due to the growth of intra-regional trade and the boost of hub-and-spoke maritime transport. Its importance is high in the South-East Asia and Europe but other regions of the world are also considering it. The American continent, particularly North America, and Australia are looking carefully at the European experience as a learning process so that they can also implement SSS or coastal shipping as it is called in some regions of the globe. Yet, there seems to be a gap between present growth rate and the goals of policy makers, namely in the European Union (EU). So far, growth seems limited to captive markets, i.e. connections of mainland with islands and deep-sea shipping (DSS) feeder services. SSS does not appear to be a real alternative to land transport, namely road haulage, when intra European trade is being considered. The logistics needs of shippers and just-in-time production philosophies have fostered the road transport usage due to its inherent advantages in detriment of waterborne transport services.

In the light of the above paragraphs, this chapter aims at looking at the European SSS arena not only for the experience gained over the years (i.e. other regions of the world can look at the benefits it offers and what needs to be done towards its implementation), but also because the lack of adequate statistical data from a regional perspective prevents a deeper insight into other SSS geographical areas. To achieve this objective, the present work is structured in five sections. Section 1 presents the purpose of the work, addresses the concept of SSS and shows the lack of consistency in what definitions are concerned. Section 2 concerns SSS market information; it considers modal split, the demand and the supply sides of SSS markets and in doing this it looks at the average size of short sea vessels. Section 3 considers SSS in a multimodal context; it investigates the geographic and economic conditions for integrating SSS in a multimodal transport chain so that a shift of cargo from road to sea takes place, looks at the factors influencing SSS competitiveness, investigates SSS obstacles and challenges and presents a list of possible policies for SSS in a multimodal context. Section 4 investigates the European SSS policies and general policies that support its development and Section 5 concerns conclusions and further comments.

1.2 A definition of short sea shipping

Despite many efforts, the literature still lacks an unambiguous definition of SSS as pointed out by Van de Voorde and Viegas (1995) and Marlow *et al*. (1997).[3,4] Some authors consider it to be the same as cabotage, i.e. all seaborne traffic between ports of the same country, sometimes including frontier ports of adjacent countries[5] while others envisage it as an alternative mode to land transport.[6] Marlow *et al*. (1997) presented a tailored definition suitable for specific situations. The authors defined SSS as seaborne flows of all kinds of freight performed by vessels of any flag, from EU Member States to whichever destination within the territory embracing Europe, the Mediterranean and Black Sea non-European countries (see endnote 4). In this regard, Peeters *et al*. (1995) acknowledged the existence of many regional-based (often European-based) definitions.[7]

Against this framework, the literature also proposes very pragmatic definitions. Stopford (1997) states that SSS is normally a maritime transport within a region, essentially serving port-to-port feeder traffic which can be in competition with land transport,[8] while Bjornland (1993) considers SSS as waterborne movement of goods that does not cross the ocean.[9] Sometimes this pragmatism turns to tautology since some authors consider that SSS includes any services which are not considered to be DSS, or which are related to relatively short distances.[10,11] Within this perspective, Papadimitriou (2001) considered SSS a maritime transport service that excludes deep sea crossing; instead, the author acknowledged that SSS embraced pure national cabotage services, maritime connections between mainland and the islands, international cabotage services as well as sea-river transport performed by coastal vessels leaving aside the pure inland waterway navigation.[12]

From a technological viewpoint, some authors focus on ships' characteristics. Against this perspective Van de Voorde and Viegas (1995) suggested that it would be better to define SSS in terms of trading patterns rather than ships characteristics, since it is not practical from an operational viewpoint the 100% exclusive use of ships in SSS or DSS (see endnote 3). The authors followed Linde's viewpoint that from a broad perspective considers SSS as a global phenomenon, but from a narrow viewpoint relates the concept to the European SSS which is operated within a large European area and managed by European shipping companies.[13–17]

The concept of coastal shipping is also addressed by Bagchups and Kuipers (1993) who defined coastal shipping as all forms of maritime transport within Europe and between Europe and adjacent regions, irrespective of whether it involves small oceangoing vessels, large ocean-going vessels or coasters.[18] Paixão and Marlow (2002), in an attempt to present a holistic definition, defined SSS as a complex maritime transport service, performed by five classes of ships capable of carrying unitised and non-unitised cargo, offered by different channel intermediaries within well-defined European geographical boundaries (see endnote 16).

At a European policy level, the concept of SSS was addressed in the 1992 communication on the European common transport policy. The European Commission (hereinafter the Commission) envisaged SSS as a means to shift goods from road to sea making use of underused capacity and the document in question does not present a definition of the concept.[19] Despite this, in 1992, the Commission defined maritime cabotage as a maritime service that embraced (i) the carriage of passengers and goods by sea between ports situated on the mainland of one Member State without call at islands (mainland cabotage); (ii) offshore supply services; and (iii) services between ports of one *Member State* where one or more ports are situated on islands (island cabotage).[20] The above definition shows that SSS clearly has a broader meaning than maritime cabotage, which seems to have a merely juridical meaning (based on state borders), instead of an economic one (potential competition between sea and land transport). The European SSS definition was first presented in its 1995 communication on SSS.[21] In an attempt to harmonise the concept, the European Conference of Ministers of Transport, the United Nations Economic Commission for Europe, and the Commission got together in 2001 and defined SSS as the movement of freight between intra-European ports and between European ports and other ports as long as the latter were located along a coastline bordering Europe as is the case of North Africa.[22] An insight into the definition provided by the Commission in 1995 (see endnote 21) clearly shows that both definitions are similar but the recently motorways of the sea (MoS) concept presented by the Commission as the "*crème de la crème*" of European SSS services[23] contributed to increase further the lack of consensus regarding a SSS definition and how these services can be decoupled from MoS services. Following the Commission's view of the MoS concept as a floating infrastructure, Baird (2007) presented the seaway concept as the ships' decks where cargo is moved, which can be measured in lane meters and compared with road and rail infrastructure, and raises the issue about public investment in surface transport, given that with a few exceptions the shipbuilding industry cannot be subsidised.[24]

Consequently, it can be said that so far there is no generally accepted SSS definition, since different criteria are used for defining it, namely (i) geographical criteria (based on the length of maritime leg); (ii) supply criteria (based on type/size of vessels, or on being part of a longer journey); (iii) demand or commercial criteria (competition with land transport; distinction between feeder or intra-regional traffic; nature of cargo); (iv) juridical criteria (ports belonging to the same state). Moreover, some definitions are tailored for a certain geographical space, or for a certain time and correspondent level of technical progress.[25] Unfortunately, the numerous and ambiguous definitions imply the non-homogeneity of the (few) available data and statistics, leading to some confusion in the scientific and technical debate. As Wijnolst *et al*. (1993) point out, statistics are often neither reliable nor consistent, since flows vary considerably according to the definition considered; definitions of import and export may also vary and differences exist also in goods classification criteria.[26]

The solution to overcome this vagueness can be linked with the possibility to choose an existing definition or proposing an additional one. The best approach should, nevertheless, outline two important keypoints underlying all the definition efforts presented in the literature. One is certainly whether land transport is possible or sea transport has no alternatives (one or both ports being located in an island without tunnels or bridges connecting them). In this case there is a captive market with no or very little competition from other modes (air transport for passengers or some high value-added goods; pipelines for liquid bulks). If a land alternative does exist, this sets a structural difference compared to DSS as for market organisation and competition between substitute issues. The framework proposed in Section 3 addresses this situation. The case for SSS competing with land transport is thus the most interesting from a theoretical viewpoint and for policies and future development.

The second key question is whether SSS is the main leg of a regional intermodal traffic, or a feeder service belonging to a hub-and-spoke cycle based on DSS. While at an intra-regional transport level SSS introduces an intermodal option competing with land transport, at a feeder traffic level it is normally the opposite: the maritime hub-and-spoke cycle is a unimodal solution where SSS competes with land transport feeders (rail or road) which would set an intermodal transport. Most remarks proposed in this chapter apply to both cases. Yet the current debate and policy issues mainly refer to the opportunities of enhancing intermodality based on a SSS leg, while less interest is shown for SSS as feeder traffic to DSS, unless this traffic can be alternatively supplied by SSS or by land transport.

2. Short Sea Shipping Market Information

Over the last four decades, the importance of SSS has been increasing all over the world especially due to the growth of feeder traffic (as a result of growing DSS transport) and the reduction of port calls in the DSS market because of increasing vessel size. With a coastline of about 89,000 kilometres (km), having 60/70% of the industries located within a 150–200 km range from a port, the EU has definitely one of the most suited geographical areas for the development of SSS (see endnote 21). In addition, a transport network made up of 97,600 km of conventional and high speed railway lines, 70,200 km of road infrastructure, 25,000 km of inland waterways (IWW) of which 12,000 km are included in the combined transport network, 439 ports of which 319 are seaports (remaining ones are IWW ports) has made EU one of the most relevant SSS markets in the world, along with Asia. Feeder trade will obviously follow the developments in transhipment hubs, which are rapidly occurring in the Caribbean, Middle East and South America. The next paragraphs provide information about the European SSS market modal split, demand and supply.

2.1 The European Union modal split

Since 1970, freight transport in Europe has grown significantly (see Table 1) as a result of the European economic growth and commercial exchanges taking place at a European and international levels. This trend has been witnessed at a worldwide

Table 1: EU-25 performance by mode: Freight transport (1,000 million tonne-kilometres)

Year	Transport modes						Total
	Road	Rail	Inland waterways	Pipelines	Sea (intra-EU)	Air	
1970*	487.0	282.0	102.0	64.0	472.0	–	1407.0
1980*	717.0	290.0	106.0	85.0	780.0	–	1978.0
1990*	974.0	256.0	107.0	70.0	922.0	–	2329.0
1991*	1006.0	235.0	106.0	79.0	956.0	–	2382.0
1995	1289.0	386.0	122.0	115.0	1150.0	2.0	3064.0
1996	1303.0	392.0	120.0	119.0	1162.0	2.1	3098.0
1997	1352.0	410.0	128.0	118.0	1205.0	2.3	3215.0
1998	1414.0	393.0	131.0	125.0	1243.0	2.4	3309.0
1999	1470.0	384.0	129.0	124.0	1288.0	2.5	3397.0
2000	1519.0	404.0	134.0	127.0	1348.0	2.7	3534.0
2001	1556.0	386.0	133.0	132.0	1400.0	2.7	3610.0
2002	1606.0	384.0	132.0	128.0	1415.0	2.6	3668.0
2003	1625.0	392.0	124.0	130.0	1444.0	2.6	3718.0
2004	1747.0	416.0	137.0	132.0	1485.0	2.8	3920.0
2005	1800.0	414.0	139.0	136.0	1520.0	2.9	4012.0
2006	1855.0	440.0	139.0	135.0	1548.0	3.0	4120.0
2007	1927.0	452.0	141.0	129.0	1575.0	3.1	4228.0

Source: EUROSTAT (various)
* Data from 1970 up to 1991 (inclusive) concerns the EU-15 rather than the EU-27.

level as shown in the UNCTAD Review of Maritime Transport and Fearnleys market reports. In conformity with Table 1, the movement of freight transport tripled from 1970 until 2006. Over this period the movement of freight by air is very small and has stabilised relatively to the total cargo being moved and according to the data provided in Table 1, it is expected that its share will remain more or less the same.

Freight movement by pipeline has increased in terms of billion tonne-km (tb-km), but from a market perspective it has lost 1.5% between 1970 and 2007. This can be attributed to the use of alternative energies which are more environmentally friendly, in detriment of the fossil oils as well as, to the fact that liquefied natural gas (LNG) is also being transported by waterborne transport, which implies that the pre- and on-carriage legs of the LNG supply chain will make use of pipelines to reach the final consumer. Although the demand for IWW transport has increased over the years, in terms of market share, it has been unable to follow the trends of sea and road transport markets. Data from Table 1 shows that its market share was reduced almost by half. Freight moved by rail has also been subject to a negative trend, even though freight being moved by rail increased from 282.0 tb-km (1970) up to 452.0 tb-km (2007).

As a result, two modes have been responsible for moving freight and for accommodating the growth that has taken place. In 1970, road transport was responsible for moving 487 tb-km, about the same as sea transport. Between 1970 and 1990 freight being moved by road doubled relatively to 1970 (the base year), and the same trend occurred between 1990 and 2007, but within a shorter period of time (16 years). The reason for such a shorter cycle is explained by the 2004 and 2007 enlargements of the EU and because data from 1995 onwards concerns the EU-27 rather than the EU-15. From a market share perspective this growth results from the ability of road transport in absorbing the market share decreases that occurred in rail and IWW, from the SSS inability to meet customers' needs and from cargo derived from growing market economies. According to 2007 data provided by the EUROSTAT, road transport is responsible for 45.6% of the freight being moved in Europe.

In what concerns sea transport, this mode has not been able to increase its market share despite the effort made by the Commission at a policy level since 1992 in the quest of sustainable alternatives to road transport. Freight being moved by sea also suffered an increase from 472.0 tb-km up to 2007, reaching 1575.0 tb-km. However, the growth cycle appears to be longer. Cargo being moved by sea doubled between 1970 and 1991 (one year more when compared to road), and because of its weaknesses it has increased only 64.7% between 1991 and 2007. The annual average growth since 1995 until 2007 is 2.8% against 3.8% in road transport which explains its market share decrease. After reaching a market share of 40.1% in 1991, SSS share of goods being moved has been decreasing relatively to road transport and in 2007 accounted for a 37.3% of the market. The data also provides no evidence that a reverse of the present trend will materialise in the near future, unless the road is subject to further strict rules and regulations as it does happen in the maritime sector and the small medium sized short sea operators adopt more collaborative strategies among them (see endnote 16). The present economic and financial crisis also does not contribute to change the above mentioned behaviour, and the question raised is how SSS is able to grasp the 14% of freight being moved by long-distance haulage.

From another perspective SSS accounts for 69% of all international traffic taken place within the

EU against 18% performed by road. SSS average journeys are longer (1,385 km) than road (100 km) (see endnote 13). The opposite situation takes place when domestic traffic is considered; here SSS is responsible for carrying 6% of the total tonnes being moved against road transport which carries over 80% of freight. Data provided in Table 1 and Figure 1 also suggest that sea and road market shares should always be under constant monitoring and an analysis between the two of them makes sense in the European arena where more and more focus is given to environmental issues.

SSS competition with land transport, particularly with road, is high due to geographical reasons and due to comparatively highly developed land transport infrastructure. To these factors, others can be added which have very much resulted from economic growth and crisis or policy changes. Examples are the opening of the European internal market in 1992, the restructure of companies' production and distribution systems, the enlargement of the EU and inventory management strategies like just-in-time, have given to road transport a real boost in its development thanks to its superior flexibility and relatively low prices.[27]–[29] Indeed, sea transport needs to be accommodated

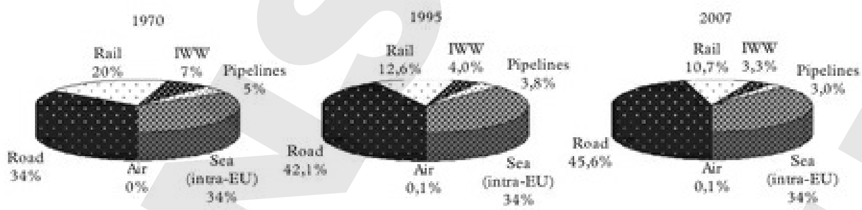

Figure 1: Modal split in %*

Source: EUROSTAT (various)

* Data from 1970 concerns the EU-15 rather than the EU-27

at specialised infrastructures (i.e. ports/terminals), breaking the overall logistics chain more often than road transportation and preventing, sometimes the information to flow smoothly among the different actors. Nevertheless, one must bear in mind than road infrastructure has been financed by public funds, to a great extent. The considerable difference between the averaged distances performed by SSS and road leads to say they are partially separated up to the distance of 300 km, since it is difficult to find an alternative to road transport inherent flexibility. The railway sector lacks investment, which explains why the potential for SSS for such short distances is not so high, unless the threshold for competitiveness with road transport is considerably shortened. This point is one of the critical issues of the recent EU transport policy as pointed out in the 2001 White Paper.[30]

The present modal split, where road and sea are responsible for about 82.9% of all freight being moved in 2007 (SSS has been able to keep up with road transport growth) can also be explained by the lack of investment in transport infrastructure since 1975, resulting in numerous bottlenecks and a daily congestion of 7,500 km, even though the Commission has embarked on the development of a comprehensive trans-European transport network to promote the modal shift to underused capacity (rail, SSS and IWW) and of a policy that resulted in the liberalisation of freight rail freight services in January 2007. As for competition with land transport the choice of lift-on-lift-off (Lo-Lo) or roll-on-roll-off (Ro-Ro) operations will depend upon the distances to be covered and port costs incurred (see endnote 16).

2.2 The demand side of the European short sea shipping market

For the purpose of the present study, only data related to cargo/freight will be considered, which implies that the movement of passengers is left out of the analysis. In the European Union 70% of its external trade and 30% of its internal trade goes by sea. Of this 30%, according to Drewry (1993), two-thirds concerns intra-North European traffic, 30% relates to trade between North and South Europe, leaving just a 3.3% of the total short sea trade as pure intra-South European movements.[31] This division of the SSS market can be explained by the higher concentration of cargo in the ports located in the Le Havre-Hamburg range, about 70% of the European industry is located mainly in the six original founder EU Member States, and because the North and Baltic Seas very much promote the use of SSS. In what concerns the movement of cargo towards the South of Europe competition with land transport is stronger both for feeder and intra-regional traffic. Channel ports are facing overcapacity due to competition from the Channel Tunnel, while the opening of road haulage to Eastern European firms has provided low cost alternatives to both shipping and railways. This has contributed to a fall in the freight rates squeezing the SSS industry profitability which has been fostered by the pressure that DSS operators exert over short sea operators when negotiating standard shipping services to the final destination.

The problem related with the analysis of the SSS demand side concerns the lack of available data at European level; only recently has this issue been addressed subject to Council Directive 95/64/EC of 8.12.1995. Table 2 shows the quantity of cargo being moved by SSS annually between 2000 and 2006. Data concerning EU-15 is available since 2000 and its annual average growth is about 30% and supports the idea that SSS has not been able to grasp cargo from road transport. From an EU-27 perspective little conclusions can be taken since data is only available from 2004 when the former Central and Eastern European countries (CEECs), Malta and Cyprus became EU *Member State*s. The only conclusion possible to be drawn at the present moment is that its annual average growth is about 2.6% which can be explained by these countries geographical location, since the former CEECs rely on road and rail modes rather than on SSS. In 2006, the total goods transported by the EU-27 SSS accounted for more than 1.9 billion tonnes, corresponding to 62% of the maritime trade. Both the North and Mediterranean Seas played a major role in the movement of goods inside the EU, reporting 599 million tonnes (28.1%) and 560 million tonnes (26.3%), respectively.[32]

From a country perspective, Ireland, Spain and Finland have witnessed the biggest annual average growths between 2000 and 2006, 6.6%, 7.5% and 4.3% respectively (see endnote 32). The Spanish annual growth is explained by the trade performed between the mainland and the islands and because some new ports have been added to the statistics. This situation highlights that the data gathered at an EU level must fill in some gaps, even though it provides a good indication of the cargo being moved. The cargo moved falls within five different categories: liquid bulk, dry bulk, containers, RO-RO units and the cargo which refers to all unknown cargo. The analysis that follows has been carried out from an EU-27 perspective.

According to 2006 data, the bulk market represents 69.2% of the cargo being moved by SSS, and seen from an individual perspective, the liquid bulk and the dry bulk short sea markets account for 49.5% and 19.7%, respectively, of the whole cargo being moved by sea (see endnote 32). These figures are in line with the 2007 statistical data provided by Drewry, where the liquid bulk and dry bulk short sea markets accounted for 50% and 20% of the overall cargo being moved on that year.[33] The main active countries in the liquid bulk market are France, Italy, the Netherlands and the United Kingdom (UK). Together they handled 624.3 million tonnes equivalent to 66.2% of

Table 2: Goods carried by short sea shipping, 2000–2006 (in million tonnes)

	2000	2001	2002	2003	2004	2005	2006
EU-15	1505.5	1563.6	1600.1	1650.6	1725.5	1792.9	1802.7
EU-27					1810.4	1892.7	1907.3

Source: Adapted from Amerini (2008) (see endnote 32)

the liquid bulk short sea market. As far as the dry bulk short sea market is concerned, Spain, Italy, the Netherlands and the UK dominate, and most dry bulk cargo is transported in cargo sizes of 1,000 and 2,000 tonnes subject to long term and spot voyage contracts.[34] Likewise, they handled 200.7 million tonnes (53.3% of the dry bulk short sea market).

Ro-Ro units follow the dry bulk short sea market (12.8%). This can be explained by the high concentration of ferry vessels' operations in the North and Baltic Seas. Germany, Italy, Sweden and the UK are responsible for the biggest share of units being handled. Together, they handled 206.0 million tonnes equivalent to 84.2% of the Ro-Ro short sea market. Interesting to see that the data for EU-15 and EU-27 are very close to one another which suggests that the new countries had a very low impact on the cargo being moved in this market segment. Most of the countries cases are self explanatory but in the case of the UK, it should be highlighted that the country is a gateway for cargo originated from/destined to Ireland which makes use of a sea-road transport system to/from mainland Europe.

Container short sea market ranks in the fourth place and has presented a 10.5% market share for both 2006 and 2007 (see endnotes 32, 33). Germany, Italy, the Netherlands and Spain dominate the container short sea market, and this is highly explained by the geographical location. In the case of Italy, the country is strategically located in the Mediterranean to the extent that divides it into two navigational areas the Eastern Med and the Western Med, and this can very much be attributed to the position of Gioia Tauro container terminal that serves about 55 different Mediterranean ports. Germany is a gateway to the Baltic and to the CEECs. The four countries handle 152.2 million tonnes which represents 76.2% of the market. Despite being in fourth place, the market for the EU-15 has witnessed an 8% annual average growth rate (see endnote 32). This explains why the container short sea market is reported to be one of the most dynamic markets of the shipping industry, both in feeder traffic and intra-regional trade.

The number of containers being moved on an annual basis can be seen in Table 3. The annual average growth rate is not provided by Amerini (2008) but the data provided shows that the number of containers did not increased considerably after the enlargement, which suggests that well strategically located ports in the EU-15 geographical area were already responsible for handling cargo particularly destined to the Central Eastern European Countries. Moreover, the number of TEUs reported empty provides empirical evidence to sustain the presence of unbalanced trades as shown in other studies caused by density of population, separation of production and consumption markets, type of goods and alternative infrastructure.[35]–[36] Germany, Spain, the Netherlands and the UK greatly contribute to this situation due to their hub-and-feeder status, and which contributes to increase the freight rates charged to the final end user.

Table 3: Containers carried by short sea shipping, 2000-2006 (in 1000 TEUs)

	2000	2004	2005	2006
EU-15	14462.9	20312.3	21946.3	22922.3
EU-27		21108.2	22751.7	23700.0

Source: Adapted from Amerini (2008) (see endnote 32)

Finally, Spain, Italy, the Netherlands and the UK are responsible for the biggest share of other cargo, totalising 72.8 million tonnes or 50.9% of the market.

Absolute trade volumes continue to rise in Europe. Growth of trade patterns will create additional demand for SSS movements and additional demand for feeder vessels. The expanding economies of the Commonwealth of Independent States (CIS) countries present further opportunities for the European SSS sector, which can only be fostered through the implementation of strict environmental controls to reduce the amount of emissions into the atmosphere. Ro-Ro and the container market offer potential for modal shift as together they account for 23.3% of the goods being moved by sea, and because the market is far from having reached a mature state. In the case of containerised cargo, the market shows a service gap since shippers have not been offered the desirable service frequency they claim since the volumes being moved are insufficient and that explains why so many containers are being moved by road.

From a port perspective, Rotterdam accounts for the biggest share of cargo handled through ports (7.4%) to be followed by Antwerp, Marseilles, Hamburg and Le Havre, most of them located in the Le Havre–Hamburg geographical range. What is interesting to see in this overall picture is that Rotterdam handled more SSS cargo (184.4 million tonnes) than deep sea cargo (168.4 million tonnes) (see endnote 32), which shows how important Rotterdam is to the overall European SSS market.

2.3 The supply side of the European short sea shipping market

The high number of journeys (of normally less than four days, e.g. the ferries that ply the Baltic Sea and the English Channel) makes management and organisation costs of SSS comparatively high, although the cost structure is very different for feeder and intra-regional markets. In the first case, costs are mainly vessel related: capital (or charter), operating and voyage costs. Overhead and administration costs are relatively small. Consequently, feeder carriers rely mostly upon chartered vessels (with the exception of a few Asian carriers).[37] In the second case, the carrier involved in intra-regional intermodal SSS will bear high costs for handling cargo and providing land transport. Administrative overhead costs will also be higher. Despite these technicalities, the definition of what is a short sea vessel is a subject of much debate since different authors present different definitions.

Hoogerbeets and Melissen (1993), state that the European SSS can be divided into three main ships' categories: the traditional single-deck bulk carriers, the container-feeder vessels and the ferries.[38] Crilley and Dean (1993) report that vessels operating in the SSS market have frequently been defined as sea-going cargo-carrying ships that transported both freight and passengers with a gross tonnage (GT) less than 5,000, and that ships with a GT less than 100, non-propelled vessels, and harbour or IWW vessels were not part of the definition.[39] Peeters *et al*. (1995) created a splitting line between short sea and deep sea vessels. The authors considered that the former comprehend all ships whose deadweight capacity is less than or equal to 10,000 deadweight tonnes (dwt) which is equivalent to an average ship of about of about 8,000 GT (see endnote 7).

Marlow *et al*. (1997) pointed out that the SSS fleet is normally identifiable as a number of carriers with similar characteristics (SSS is usually performed by vessels up to a certain size and conversely vessels up to a certain size are usually deployed in SSS). Even if these parameters are likely to change significantly over time, they estimate that SSS include tankers and bulk carriers up to 13,000 GT and/or 20,000 dwt; general cargo and break bulk carriers up to 10,000 GT and/or 10,000 dwt; and combined passenger/cargo ships and Ro-Ro vessels between 1,000 GT and/or 500 dwt and 30,000 GT and/or 15,000 dwt (see endnote 4). Stopford in 1997 considered SSS vessels to be within the 400 to 6,000 dwt range against some authors that talk about 10000+ dwt (see endnote 8).

Paixão and Marlow (2002) identified five types of SSS vessel categories (i.e. the traditional single-deck bulk carriers, the ferries, container feeder vessels, a fleet of bulk carriers and tankers and sea-river ships often with retractable wheelhouses), provided and individual description of each of the vessels and investigated the differences between Lo-Lo and Ro-Ro operations (see endnote 16). This classification which partly agrees with the one provided by Hoogerbeets and Melissen (1993), is similar to the one provided by Verlaat (2008) (see endnote 38).[40] The difference between Verlaat and Paixão and Marlow is that the former considered the fleet of tankers, dry bulk carriers and traditional single-deck bulk carriers often used in the carriage of neo bulk within the same category of conventional ships.

Besides the traditional ships mentioned in the above paragraphs, the short sea market has been witnessing a trend towards the introduction of faster ships such as wave pierce catamarans, air cushion vehicles, hydrofoil, surface effect ships, and the small waterplane area twin hull (SWATH). Their main problem concerns their consumption levels to perform their designed service speed; any increase in their speed means an increase in the cost of bunkers, a decrease in their cargo carrying capacity meaning a revenue reduction. The question to be raised at this point is to ask shippers about their interest in having their cargoes being moved by this type of vessels. Despite being able to shorten cargo transit times and provide high service levels, how far they are willing to pay higher freight rates when Becker *et al*. (2004) recognised that the high speed vessel market offers potential to compete with certain road transport market segments.[41]

Overall, short sea ships are normally much smaller than deep sea ones although there is a trend towards an increased vessel size. Several reasons explain why such vessels are small: (i) demand is normally weak for SSS routes; and (ii) the high number of short journeys requires smaller ships in order not to spend too much time in port calls. The lack of an unambiguous definition, towards the size and types of ships that work in the SSS market, causes additional problems when authors try to characterise the fleet operating in this market which may be a reason why most studies on fleet analysis set the dividing line between SSS and DSS at 10,000 dwt or 6,000 GT.

According to a Lloyd's Register survey quoted in Peeters *et al*. (1995), by the end of 1992, the world SSS fleet amounted to 68.5% of the existing fleet corresponding to 9.6% in terms of GT, 8.9% in terms of the total dwt carrying capacity with an average size equal to 1,319 GT. From a European perspective, the same survey estimated that the European SSS fleet amounted to 57.3% of the existing European fleet corresponding to 7.9% in terms of GT, 6.7% in terms of the total dwt carrying capacity with an average size equal to 1654 GT. The figures reported on ships which are supposed to be employed in SSS show that on a worldwide basis there seems to be a quite constant share of ships employed in SSS, as well as in terms of GT and dwt. The same survey showed that general cargo and liquid bulk carriers prevail in the EU SSS fleet. Peeters *et al*. went on saying that the average age of the world SSS fleet was 18 years, two years younger than the European one that amounted to 20 years (see endnote 7).

The Colton Company (1997) estimated that the European SSS fleet was made up of 5,650 units embracing 5,000 sea-river ships often with a retractable wheel house, 400 containerships ranging between 100 and 700 TEUs and 250 Ro-Ro ships. Most popular container ships moved 200 TEUs and the most popular sizes of sea-river ships presented deadweight capacities between 1,500 and 2,200 tonnes.[42] However, the data provided presents two main problems since the short sea dry and liquid bulk carrier fleet was left out of the calculations and there is no reference to the year that the data relates to. The Commission in its report on the implementation of Council Regulation 3577/92, presented data relatively to the 1996 and 1998 SSS fleet (see Table 4), and considered for this purpose ships of less than 10,000 dwt.[43]

The data supplied by the Commission does not discriminate the type of ships being considered which prevents from having a real perception of the composition of the actual fleet. What type of ships predominate in each group of Member States is unknown and even if the ratio of dwt to GT were to be used to identify if the fleet is mainly formed by passenger/cargo ferry and Ro-Ro (ratio of dwt to GT below 1) or by tankers and dry cargo vessels (ratio of dwt to GT above 1), its outcome would be far from being a reliable one. The data supplied by the Commission also shows no evidence that sea-river ships have been included in the calculations and so, the number of ships calculated for 1998 are well below those estimated by the Colton Company in 1997.

The only possible conclusion is that the SSS fleet has increased in numbers and in dimension but very slightly. The average SSS vessel size in terms of GT and dwt for 1996 were 4,267 and 4,909, respectively and that the figures for 1997 amount to 4,288 and 5,149, respectively. Various studies on the SSS have observed a gradual increase in the average size of the SSS vessel. According to Dynamar quoted in Peeters *et al*. the SSS vessel average size increased from 1,400 dwt in 1970 up to 2,000 dwt in 1980, and up to 2,400 dwt in 1990 (see endnote 7).

According to Lloyd's Marine Intelligence Unit (LMIU) quoted in Wijnolst (2005) the 2003 European SSS fleet from Baltic Sea to the Black Sea comprehended 10,000 ships between 500 and 10,000 GT of which 3,825 and 2,110 ships were older than 25 and 30 years, respectively and that a total of 3,460 shipowners operated in the European short sea market.[44] Part of the 2004 world short sea fleet can be seen in Table 5 since vessels operating on the SSS were aggregated in eight different categories, rather than in ten as shown in Table 6. Smits left out the general cargo and ropax fleets which according to the 2007 data represent about 47% of the world short sea fleet and all vessels below 1000 dwt which are about 10,000 vessels,[45] and such a situation

Table 4: EU-15 short sea shipping fleet (GT and dwt 1000)

	1996			1998		
	Number	GT	Dwt	Number	GT	Dwt
Northern Member States	2018	8609	10932	2091	8520	11349
Southern Member States	1252	5343	5120	1428	6570	6772
	3270	13952	16052	3519	15090	18121

Source: European Commission (2000) (see endnote 43)

Table 5: 2004 World short sea shipping fleet

Vessel type	Number of vessels	Total deadweight (dwt)	Average deadweight (dwt)	Total cargo transported (tonnes)
Bulk fleet	2,523	42,270,141	16,754	513,761,250
Reefer fleet	1,027	4,232,991	4,122	80,010,000
Container fleet	1,592	16,868,102	10,596	451,822,000
Oil tanker fleet	357	9,359,581	26,217	153,367,200
Product, chemical fleet	2,206	13,143,522	5,958	312,840,000
Ro-Ro fleet	1,185	7,607,750	6,420	294,336,000
LNG fleet	15	288,205	19,214	4,617,000
LPG fleet	945	4,970,303	5,260	90,420,000
Total	9,850	98,740,595	11,817	1,901,173,450

Source: Adapted from Smits (2007) (see endnote 45)

Table 6: 2007 World short sea shipping fleet at the end of the year

Vessel type	Number of vessels	Total deadweight (dwt)	Average deadweight (dwt)	Total cargo transported (million tonnes)
General cargo fleet	16,601	76,568,255	4,612	1,729
Dry bulk fleet	7,366	384,735,783	52,231	2,603
Reefer fleet	1,217	6,598,420	5,422	129
Container fleet	4,205	100,395,981	23,875	1,902
Oil tanker fleet	2,055	293,989,385	143,061	1,854
Product, chemical fleet	3,626	56,782,773	15,660	943
Ro-Ro fleet	2,360	16,731,136	7,089	507
Ropax fleet	2,728	3,943,400	1,446	
LNG fleet	248	17,075,828	68,854	97
LPG fleet	1,080	12,311,988	11,400	152
Total	41,486	969,132,949	33,365	9,916

Source: Adapted from Lindstad (2008) (see endnote 47)

creates a distortion relatively to the 2003 data. Nevertheless, if the percentage split provided by Peeters *et al*. (1995) is applied, (i.e. the EU-27 short sea fleet amounts to 31.5% of the world short sea fleet) what can be said is that the European short sea fleet embraces about 9166 vessels including those with a deadweight below 1,000 tonnes. Shipowners based in Germany, the Netherlands Greece and Italy dominate the market and control 62% of this short sea fleet.[46]

Table 5 also provides the average deadweight for the eight vessel segments, and what can be said is that short sea vessels' sizes have increased for the past years, which meet the findings reached by Marlow *et al*. in 1997 (see endnote 4). The added value of Table 5 rests on its ability to provide more detailed information for the different types of cargo being moved by sea rather than the statistics provided by the EUROSTAT, but prevents possible comparisons with the data gathered by other consultancy houses and/ or eventually EUROSTAT.

The Lloyd's Fairplay data of the worldwide short sea fleet quoted in Lindstad (2008), shows that at the end of 2007, the world short sea fleet includes 10 vessel categories and is much more accurate than the 2004 data.[47] With the assumption that the EU-27 short sea fleet represents 31.5% of the world short sea fleet, it can be estimated that the EU-27 short sea fleet has about 13,050 units, which means an average yearly growth of 7.6% relatively to 2003 where data quoted in Wijnolst (2005) was provided by LMIU. The average size of short sea vessels goes on increasing and against the findings of Corres and Psaraftis who estimated the average size of short sea vessels to be around 11,000 dwt by 2007–2008,[48] the average size appears to be within the range of above 30,000+ dwt, much at the expense of the tanker fleet size employed in the SSS market.

The biggest problem of the European short sea fleet is still its age and the main concern of an ageing short sea fleet is its pollutant emissions which in 2000 accounted for 36% of the total nitrogen oxide (NO_x) and 6% of total greenhouse emissions. The problem of an ageing short sea fleet is not new, since it has already been mentioned by Øvrebø in 1969 (see endnote 25) and more recently by Lowry in 2008 who identified that the dry bulk short sea fleet had an average age of 31 years (see endnote 34). This suggests that a renewal scheme is desirable for SSS to be competitive with road transport and to be integrated into multimodal/intermodal transport chains. The absence of legislative measures enforcing the renewal of the fleet has been a negative influence since until recently the dwt of most short sea vessels was under 5,000. Moreover, short sea operators do not possess sufficient funds to embark on a short sea fleet renewal programme, the costs of building a small ship are four-and-a-half times more per dwt, and bank credit is very expensive (see endnote 48).

The resultant reduced profitability is therefore a serious strategic concern in capital intensive companies planning for growth and the renewals that have taken place result more often than not from the existing rivalry between shipowners operating in this market, from port state control inspections and the enforcement of important legislation to protect the environment. Most focus has been giving to the development of efficient vessels ranging from 30,000 up to 300,000 dwt while the SSS fleet has been more or less neglected. Nevertheless, this trend has started to reverse due to the numerous research and development projects being funded by the European Commission in last years in the quest for more efficient ships such as the CREATE3S new generation of short sea vessels,[49] the ENISYS ship concept[50] or generic short sea vessels based on a common platform and built in series as it happened in the past (see endnote 48). In 1994, Wijnolst *et al*. had already acknowledged that SSS technology and operations needed to be changed before any significant modal split materialised.[51]

The point is that new ships are needed to compete with road transport on cost, speed, flexibility, reliability without jeopardising safety and the environment, attractive sailing times, maintained transit times, and guarantee of delivery. Two key aspects that these ships must target are the reduction of the turnaround time in port and the ability to develop intermodal solutions that meet the needs of the entire logistics chains. If significant reductions of 20–25% are achieved in terms of cost and lead time a modal shift is expected to occur (see endnote 50), an improvement relatively to the 35% reduction required to shift cargo from road to sea as suggested by APAS in 1996.[52] Under the present environment and taking into account the modal split presented in Figure 1, an analysis of SSS in a multimodal supply chain context makes sense in the European arena, as competition with land transport is higher due to geographical reasons and to the comparatively highly developed land transport infrastructure.

3. Short Sea Shipping in a Multimodal Supply Chain Context

3.1 Geographic and economic conditions for developing short sea shipping: a theoretical framework

Maritime transport is normally part of a transport cycle involving other transport modes. The maritime leg can be a complex cycle, when organised from a hub-and-spoke perspective, involving ships of different size to attain economies of scale/density on some routes. Since the goal is to attain the cheapest, fastest and most reliable transport conditions (i.e. to minimise the generalised cost), the demand for sea transport is related to the generalised cost of the whole transport cycle. From a microeconomic approach, the use of generalised costs explain the user's choice (i.e. providing transport solutions for producers), but the use of total costs (including infrastructure and external costs) from a macroeconomic approach explain general utility enabling a shift of volumes from congestioned land infrastructure to sea.

The proposed framework considers jointly geographic and economic conditions involved in the mode choice, and identifies the critical thresholds in land/sea distances and land/sea generalised costs which determine SSS potential competitiveness. It applies either to the case of a SSS intermodal chain competing with land transportation, or to feeder traffic for DSS. The boost of intermodality over the last 30 years is due both to increasing benefits and decreasing transhipment costs, as: (i) the growth of world trade allowed economies of scale not conceivable before, also because production functions are more capital intensive and involve relevant fixed costs; and (ii) new handling techniques reduced costs, times and risks of transhipment. If SSS replaces a part of a journey otherwise performed by a single vehicle, the additional modal change implies higher generalised costs. Total time increases, while reliability, punctuality and safety are jeopardised by bottlenecks, congestion, mistakes, damages, among others. These costs are compensated by savings that the different modes/vehicles allow in the different part of the journey, because of changing cargo volumes and economies of scale/density. SSS is chosen when the optimisation of modes/vehicles on the different legs generates benefits higher than the additional transhipment costs. In both key areas (feeder traffic and intermodal traffic competing with land transport) a simple cycle is replaced by a complex one. Unlike SSS captive markets, where there is no user's choice and the goal is to minimise generalised costs of modal change, SSS is chosen only if it allows generalised benefits higher than the generalised costs of additional transhipments.

Therefore, the problem under study fits within the approach *à la* Hoover[53] as it accounts for different terminal and haulage costs of the different modes, which cause different costs per mile, which explains why different modes have a different competitiveness for different distances, and therefore different markets and why at a European level, the different modes are competitive in different distances.[54] While road transport has low terminal costs but relatively high line haul costs, sea transport has high (generalised) terminal costs but comparatively lower transport costs and rail has intermediate levels for both terminal and transport costs. Since terminal costs do not vary with distance, road transport will be cheaper on shorter journeys and sea transport on the longer ones. Such a framework points out the conditions for SSS competitiveness. The paragraph that follows considers the case of SSS as a main leg of an intra-regional transport chain, competing with land transport. The approach is similar if a feeder traffic case was being considered.

In Figure 2, a journey *OD* is considered, where in the central leg *AB* both road and sea transport are available, while only road transport is available in *OA* and *BD*. The function a shows total transport cost if only road haulage is chosen. The function *b* shows the cost of transport using SSS in the central leg. While modal change costs are added in *A* and in *B*, a lower cost is paid on the leg AB. SSS is then advantageous when *AB* is long enough to compensate higher terminal costs.

Unless *O*, *A*, *B* and *D* are aligned, Figure 2 only accounts for economic conditions and not for geographic conditions when competition is being considered. To find out the combination of economic (transport and terminal costs) and geographic variables (land and intermodal distances) which jointly account for SSS competitiveness, a land transport *OD* by mode m_1 (e.g. road haulage) and an alternative *OABD* based on mode m_1 for *OA* and *BD* and on SSS indicated as mode m_2 for *AB* must be compared. Ports *A* and *B* are not aligned with *OD*.

If *x* is the maritime distance between ports *A* and *B*; T the transhipment generalised cost in ports; tm_1, tm_2 transport rates per mile of a given cargo unit; and *C* and *S* terminal costs in *O* and *D*; then total transport costs are:

$$C + tm_1 \cdot OD + S \tag{1}$$

for road transport *OD*, and:

$$C + tm_1 \cdot OA + T + tm_2 \cdot AB + T + tm_1 \cdot BD + S \tag{2}$$

for intermodal transport OABD. The competitiveness of the latter is then given by (1) > (2):

$$tm_1 \cdot (OD - OA - BD) - tm_2 \cdot AB - 2T > 0 \tag{3}$$

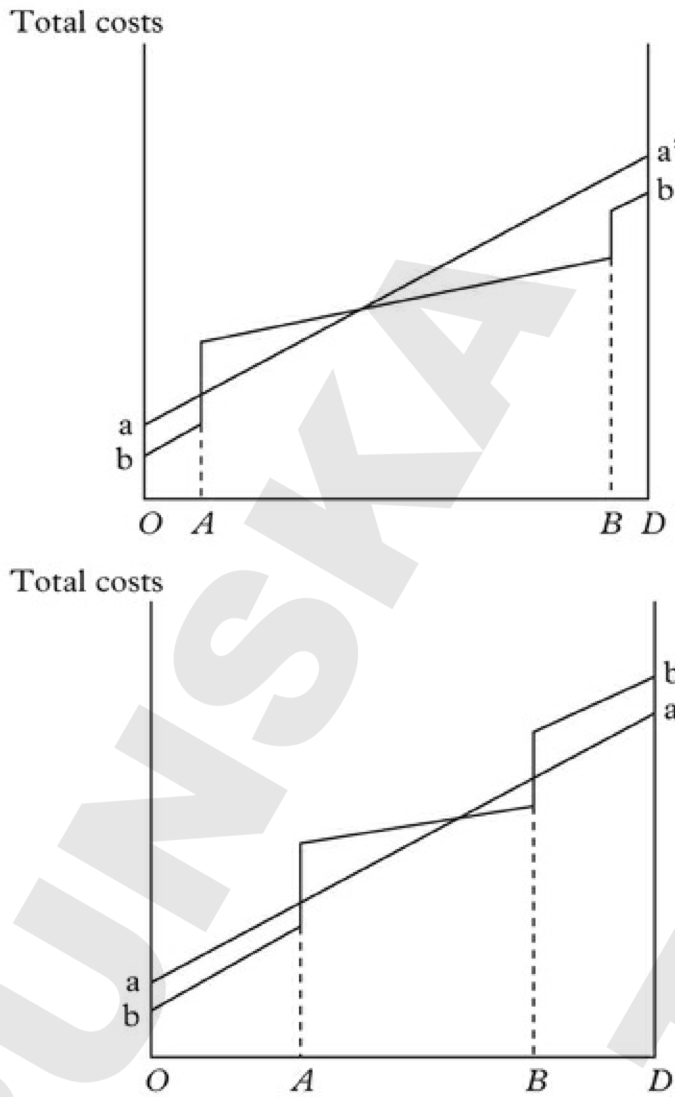

Figure 2: Total transport costs: all road vs. SSS

If y is the difference between road distance OD and feeder road legs OA and BD of SSS transport, the (3) can be written as:

$$y > \frac{tm_2}{tm_1}.x + \frac{2T}{tm_1} \tag{4}$$

setting the combination of geographic and economic conditions for competitiveness of SSS, as in Figure 3. Each journey OD identifies a set of (x, y) satisfying or not the condition (4), according to transhipment costs, and rates per mile of modes m_2 and m_1. Obviously the competitiveness increases by reducing T or tm_2, or by increasing tm_1.

A key point is that if m_2 allows more relevant economies of scale than m_1, as is normally the case for short sea compared to road transport, the increase in traffic flows reduces the slope of the (4), thus increasing competitiveness of the former. This is just a joint representation of geographic and economic conditions which make viable a SSS-based alternative to land transport. The approach *à la* Hoover allows finding out each transport mode economic distance since (i) terminal and transport costs weight

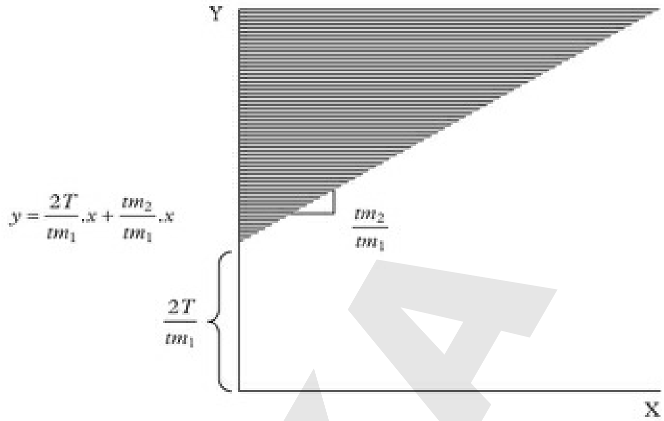

Figure 3: Geographic and economic conditions for competitiveness of SSS

differently in different modes; (ii) costs in different modes are a function of cargoes and cargo units characteristics; (iii) reducing terminal costs in ports lowers the threshold distance for SSS, as it moves downwards the (4); and (iv) higher returns to scale in SSS cause a growth in traffic to reduce SSS threshold distance, by a rotation of (4).

Thus, SSS economic competitiveness relies upon the contemporaneous occurrence of five conditions which are: (1) cargo volumes involved cause pure transport costs for sea transport lower than for road transport; (2) different origins and/or destinations do not allow to employ the sole maritime transport (since cargo volumes do not fulfil the condition (1)); (3) distances involved are longer than the threshold distances for sea transport; (4) location of origins/destinations of single shipments allow the unification of parcels on some legs in order to satisfy condition (1); and (5) lower generalised costs of using the best transport mode on each leg are higher than additional generalised costs deriving from transhipment. According to Baird (1997) for a coastal service in the UK to be successful, it would need to guarantee that the costs were competitive, goods delivery times were maintained, and the service was reliable relatively road transport alone (see endnote 35).

When referred to SSS as feeder traffic, different returns to scale account for the hub-and-spoke organisation. Limits to economies of scale are now on the demand side, and increasing returns to scale can be pursued only by grouping cargoes on the main leg. Volumes and costs per mile being equal, the longest is the main leg AB, the most competitive is the hub-and-spoke solution using SSS. Conditions (1), (2) and (5) will be here referred to thresholds for ships of different sizes. Condition (5) will refer to transhipment from SSS to DSS.

As for competition between SSS and road transport for the feeder service, since a haulage feeder service is normally needed for the final part of the journey, the comparison is between savings allowed by maritime feeder and costs of an additional transhipment (from the feeder to the deep-sea ship), that is:

$$(tm_1 - tm_2) \cdot OA - T > 0 \qquad (5)$$

The same conditions apply, since there are combined effects of economic distance, size of shipments and location of origins/destinations.

This approach outlines the conditions that make SSS competitive, even when not forced by geographical (or, in the short run, infrastructural) constraints. The same framework applies to both main current strategic areas of SSS: an intermodal transport competing with land transport, or a feeder traffic competing with road/rail feeders. As already noted, this framework allows both a microeconomic and a macroeconomic approach, with different implications. In the former, short term generalised cost (given the infrastructure) account for behaviour of transport operators and consequent modal split. In the latter, total direct and external long run costs (including infrastructure and energy) account for a macroeconomic comparison, resulting in a cost-benefit assessment which pursues a higher welfare.

In its microeconomic approach, the proposed framework refers to generalised, not to out-of-pocket costs. Generalised costs correspond to production costs only in perfect competition. In freight transport, shippers happen not to decide transport mode neither select the route, and multimodal transport operators (MTOs) are likely to choose modes/routes according to their convenience. Monopoly, or collusion between providers (e.g. due to horizontal and vertical integration of the supply chain) can cause a substitution between time and cost, reducing costs and increasing times without (or with little) reduction of prices for shippers. The case for passenger transport is different, since users directly choose the mix of modes by comparing the generalised cost of each solution, and their preference will thus account for their choice. It is probably no accident that intermodality is barely chosen unless forced by geographical constraints or by huge savings in monetary costs, or unless other options are totally congested or restricted.

In other words, intermodality allows increasing productivity, but may cause a decreasing quality (for the cargo, not necessarily for the vehicle) with higher time and lower reliability, punctuality and safety. If there is not a high level of competition this trade off may encompass a transfer of costs from the producer to the consumer. The market organisation is then crucial for the benefits to spread on the demand side, allowing higher accessibility of regional markets, specialisation of production, and cumulative growth of regions involved.

3.2 Factors influencing the competitiveness of SSS

According to Sub-section 3.1, the more SSS will be competitive, the more substantial reduction in generalised port costs is attained; the longer is the maritime leg with respect to the total length of the journey; the higher is the ratio of y to x in (4); the bigger are cargo volumes; the higher is the ratio of land transport generalised costs to sea trans port ones.

Besides these key issues, some additional remarks are worthwhile. First, the growing importance of ports and their performance/efficiency involves not only efficient modal change and handling, but logistic and distribution functions. Choices concerning number and location of ports and logistic platforms on which the SSS network will hinge are strategic, since they pursue the optimal trade off between economies of density, pushing for concentration of flows which reduce the ratio tm_2/tm_1 in (4); and minimisation of road feeders, pushing for dispersion of flows which cause higher values of y and positively affects (4). Case-by-case search for optimal equilibrium is a major operational research issue, and a key issue for SSS development strategies. It is notable that virtually all issues highlighted – threshold distances, demand volumes and their origin/destinations, returns to scale in competing modes, number and location of intermodal nodes, etc. – have been addressed so far in a largely empirical way, frustrating most of the potential of SSS. There has been no strategy at all, and SSS nodes have followed, more often than not, strategies of big transport operators.

Another point implicit in (4) is that implementing SSS should not result in fragmentation and complications of relations between shippers and transport operators, difficulties in organising and controlling the logistic chain, problems arising from liabilities, damages or losses, among other issues. This means that implementing SSS requires the integrated management of the entire SSS-based logistic chain. On one side the risk is that economies of scale/scope related to the management of the whole logistic cycle can set relevant barriers to entry, issue of alliances and co-operation strategies. On the other side, if the control of the chain is taken up outside the maritime link, this may squeeze profitability and limit operational control of SSS operator, who faces, in a door-to-door cycle, relevant fixed costs, and does not enjoy any spatial protection of its market, thus coupling high competition and low profitability. Moreover, by operating on one link of the chain, there is no influence/control over the quality of the door-to-door service, and no control on key factors influencing the demand; comparison between SSS and competing modes requires that the whole cycles are compared.

The above mentioned factors, although not explicitly modelled in the proposed approach, are likely to influence deeply the cost elements of (4), which can vary with high levels of uncertainty, not proportionally to distance, and change rapidly over time. In this context, Paixão Casaca and Marlow (2005) investigated the service attributes required by shippers when making use of multimodal transport chains comprising a sea leg. The authors found out eight dimensions which differed from the ones advocated in the several policy documents of the Commission and which comprised by decreasing order of importance (i) carrier's logistic network design and speed; (ii) cost of door-to-door service, its reliability/quality; (iii) the carrier's behaviour during sales and after-sales; (iv) carrier's involvement in the forwarding industry; (v) service guarantee; (vi) carriers' corporate image; (vii) carriers' commercial/operational policies and their relationship with shippers and finally (viii) investment policy.[55]

3.3 Putting short sea shipping in operation: obstacles and challenges

Any further SSS development will necessarily rely upon its possible microeconomic competitiveness (in terms of generalised costs), more than upon its macroeconomic desirability. Yet, since most researcher and policy makers agree on the need of enhancing SSS, it is useful to resume a checklist of main benefits and costs from the macroeconomic and political viewpoint. Paixão and Marlow (2002) have listed SSS strengths and weaknesses (see endnote 16) and a summary of the benefits offered by SSS can be summarised as follows:

- low environmental costs: it generates much less emissions per tonne-km (tkm) caused by the average transport (average goods, average road and rail gradient, average energy split) in Europe than road and rail transport, as shown in Table 7.

Table 7: Polluting emissions (grams for tonne-km)

Transport	Energy consumption EC (kJ/tkm)	Carbon dioxide CO_2 (g/tkm)	Nitrogen oxide emissions NO_x (mg/tkm)	Sulphur dioxide emissions SO_2 (mg/tkm)	Non-methane hydro carbons NMHC (mg/tkm)	Dust‡ (mg/tkm)
Road traffic* (>34-40 t; Euro 3)	1082	72	553	90	54	16
Rail transport†						
average electric train	456	18	32	64	4	4,6
average diesel train	530	35	549	44	62	17
Air transport	9,876	656	3,253	864	389	46
Waterway (upstream/ downstream)	727/438	49/29	839/506	82/49	84/51	26/16

Source: Knörr and Kutzner (2008)[56]
* for additional data see Table 10 in Knörr and Kutzner (2008).
† based on the EU-27 energy split.
‡ By dust is meant "*total exhaust particles from vehicles and from energy production and provision (mainly power plants, refineries, sea transport of primary energy carriers), composition: all particle sizes, about 80% PM 2.5, 90% PM 10 (by mass)*".

- fewer accidents, namely for human life safety: in 2007, 42,448 fatalities occurred in road accidents within the EU-27 corresponding to 99.8%, and 76 losses of lives were registered in rail transport (excluding suicides); air transport was responsible for four losses, but this figure increased up to 181 in 2008.[57] Data provided by EUROSTAT does not include sea losses, however according to Lloyd's Register Fairplay data provided by the International Chamber of Shipping and the International Shipping Federation Website sea transport was responsible for about 260 losses of life worldwide, which shows how safe this mode of transport is.[58]
- lowering congestion of land transport networks: presently 7,500 km of roads are congestioned on a daily basis;
- low energy consumption;
- larger economies of scale;
- higher flexibility of transport costs to shifts in demand, and low need for new infrastructure;
- more competitive environment than for (rather monopolistic) land transport networks;
- advantages for maritime economy and namely for shipyards;
- development of peripherals and isolated regions (of difficult or impossible access with other transport modes), and enhanced competitiveness of hinterlands economies facing international markets.

On the other side, the development of SSS also brings about some disadvantages, such as:

- partial increase of pollution: unlike other emissions, sulphur dioxide (SO_2) emissions are much higher than in other modes (see above);
- partial increase of accidents, namely with major environmental damages;
- congestion in port nodes;
- negative impact on other transport sectors, as well as on the industry of infrastructure construction and related sectors;
- low flexibility in service times, due to larger unit capacity and consequent lower frequency of service for any origin/destination (O/D) link;
- lower reliability of scheduled departure and arrival times (mainly due to weather conditions);

- higher risk of damages and loss.

It is not sure a *priori* that the comparison between costs and benefits is always positive, even if most policy makers consider costs largely exceeded by benefits since to absorb road traffic a minimum distance of 1,500 km is required.[59] Nevertheless, some points should be highlighted:

1. As for environmental effects, the balance is likely to be positive, since SO_2 higher emissions can be reduced (see below). Nevertheless, nobody can extrapolate this statement on a long term, as no forecasts on future levels of polluting emissions are highly reliable, namely for land transport, where a major research effort is being done to attain propulsion systems environmentally friendly.
2. As for congestion of transport infrastructure, the congestion of land transport network is clearly more damaging and less remediable, for the economy as a whole, than the congestion of existing port nodes.
3. Under the viewpoint of economic effects, namely in total production costs of transport, clearly the lower flexibility of land transport costs is replaced by a lower flexibility in transit times and a lower punctuality; there is a trade off between quality and cost, and the effects on demand are likely to be different for different segments of the market (as for types of cargoes and cargo units), due to different values of price-elasticity and time-elasticity.
4. As for macroeconomic Keynesian impact, the replacement of a demand in land transport and infrastructure construction with a demand in maritime transport, shipyards and port infrastructure construction, needs to be carefully investigated and quantified; yet it does not appear a reason to stop a possible change if otherwise desirable.

Even if case-by-case assessments and surveys can lead to results sometimes different, it seems acceptable that in a macroeconomic vision SSS should develop further, and that policies aiming at implementing it are consequently well founded.

3.4 Possible policies for short sea shipping in a multimodal context

If previous paragraphs showed that some conditions influencing SSS are given (on the geographical side, land and sea distances; as for demand, the nature of cargoes, and, to some extent, their volumes), most other elements influencing competitiveness of SSS can be changed through suitable policies. Nevertheless, it must be clear that what jeopardises the competitiveness of SSS is the unfair competition played by land transport, namely road haulage, in terms of much higher environmental costs, and much higher public financing of infrastructure. Strictly speaking, equalising environmental and fiscal externalities of all transport modes should be the ultimate goal of any policy aiming at a fair modal split (and not simply at the growth of SSS, which might well be not desirable). As a consequence, first best policies for SSS do not concern necessarily SSS, but should focus on internalising major external costs of land transport.

In the light of the above paragraphs, and taking into account the framework outlined above, a number of actions which apply to different areas can be identified. Firstly, ports are key nodes for the effectiveness of SSS, since ships' times in port are high and amount to more than 60% of ships' total voyage time and represents 70 to 80% of waterborne transport services total cost or more than half of maritime freight (see endnote 21).[60] A well-defined port strategy can greatly influence a modal shift towards the use of SSS. Instead of focusing only on inter-port competition, ports should determine their SSS hinterland, look at shippers' requirements in order to facilitate short sea operators. The actions listed below to promote modal shift should increase fluidity of transit in ports, reliability and on time delivery, by minimising quality components of generalised cost.

Second, comparisons between transport rates highlight two areas where positive actions can be deployed: internalising all costs following the user pays principle, or at least equalise the level of external costs. These actions, involve infrastructure, turn to land use/planning policies, developed either for optimising transport performance, or for reinforcing the cohesion and economic proximity of different regional economies. Finally, policies can involve the transport industry and providers of transport services, by inducing changes both into the market and technical/industrial organisation, and on cargoes and shippers' organisation. Policies and actions appear to fall into seven main strategic areas namely infrastructure policies, law and regulations, commercial actions, organisational actions and policies, pricing policies, technological actions and logistics strategies. The paragraphs that follow describe each of these policies.

Infrastructure policies. Infrastructure policies address both planning/construction and location of infrastructure that influence SSS competitiveness. Main actions include:

- improvement of ports to the needs of SSS, namely widening space for SSS traffic (most present terminals would be inadequate if SSS attracted relevant traffic flows), modification of ports' layout and creation of dedicated terminals/areas;
- improvement of handling plants in ports, namely through a further diffusion of containerisation in SSS;
- enhancement of port accessibility and connections between ports and land networks (road and rail); since competition between road and rail has been estimated around 170-250 km,[61] connections with rail networks are crucial for expanding ports' market areas;
- IWW development and promotion of a better balanced modal split between land transport and IWW, whose integration with SSS is easier and more efficient than for land transport;
- redesign port procedures to eliminate activities that create costs;
- make use ofVTMIS to continuously monitor vessel arrival in port and as such introduce just-in-time procedures to improve port capacity management.

Law and regulations. These aim at enhancing competition to increase the efficiency and attract further investment and at eliminating distortions caused by excess of regulations for SSS, and lack of environmental regulations (or of their enforcement) on road transport. Main actions should include measures targeting at:

- liberalising access to market, namely abolishing flag reservations on domestic traffic, including the concept of public service;
- integrating bureaucratic (customs/administrative) procedures in order to simplify/reduce difficulties and times (the MarNIS EU research project output can be a means to achieve this end);
- equalising external costs;
- integrating different contracts and liabilities;
- regulating port services and their inputs, thus allowing a higher efficiency of port operations.

Commercial actions. They seek to overcome the perception of SSS as an obsolete, not transparent, and not suitable mode of transport for the present needs of production and logistics, with low flexibility, reliability, frequency and speed. Measures needed include:

- restoring the image of SSS from that of an old-fashioned, slow and complex transport mode to a modern element in the logistic chain, characterised by high speed, reliability, flexibility, regularity, frequency, and cargo safety;
- clearly show the difference between SSS and other modes of transport, in particularly road;
- information aimed at restoring trust; logistic operators and shipowners should fight for market transparency and to promote information on conditions of supply;[62]
- specific information on safety (see above) helping to promote a positive image;
- define and publicise key performance indicators.

Organisational actions and policies. These actions involve either the industrial or the technical organisation with the purpose of reorganising SSS-related operators. Such actions should:

- reorganise and allow a better modal integration to fulfil just-in-time requirements and compensate the additional breaks of bulk; frequency and reliability of scheduled times are the key issues, which implies the existence of 24/7 port services, and a better organisation of storage/distribution areas;
- stimulate co-operation and collaboration of SSS operators as suggested by Corres and Psaraftis (see endnote 48), stimulate co-operation of SSS operators with shippers and forwarders to offer comprehensive networks and door-to-door services at competitive prices, thus integrating the strengths of different modes into seamless customer-oriented services. Either SSS operators need partners to carry out the land legs of intermodal chain, or land operators must be ready to use SSS for a relevant part of their journeys at the expense of short sea operators losing control over the market. A good example is the Turkish company UN Ro-Ro that operates several trade routes between Turkey and Italy;
- concentrate SSS flows on a limited number of ports, in order to achieve higher economies of density and provide more frequent services; possibly locate them close to major metropolitan areas in order to be more competitive in delivery times; the MoS concept is an opportunity to achieve this objective so that a guaranteed service quality and frequency is obtained;
- promote specialisation of terminals and alliances between port operators;
- promote concentration in the road haulage industry, to incentive road-SSS intermodal journeys which are more competitive for non-accompanied trailers;
- promote standardisation of cargo units (e.g. "europallets" do not allow a standard ISOl maritime container to be filled with two rows of pallets) in order to reduce costs of modal change in those trades where these standardised cargo units are possible;
- locate value-added services (VAS) in SSS ports to better integrate port functions with logistical services provided by forwarders and MTOs.

Pricing policies. Since the quality component of generalised cost is comparatively high, SSS must be cheaper in monetary costs.[63] Some possible price-based actions are:

- compensating lower quality (higher times for ships and cargoes) by lower prices; Pettersen Strandenes and Marlow (2000) suggest a two-parts port tariffs partly related to port stay and waiting time: prices inversely related to quality should enhance competitiveness of SSS and incentive port operators to improve quality[64];

- pricing policies promoting fair competition between transport modes by: charging for the cost of building infrastructure in all modes (the user pays principle); harmonising financing and pricing policies in different ports; internalising external costs,, particularly in road haulage;
- lowering port taxes (which, unlike pricing for using infrastructure, does not correspond to a real recovery of production cost) indirectly to attain the same results.

Technological actions. The age and the low specialisation of SSS ships are consequences, rather than causes, of low profitability. Higher investments in new ships and R&D, and generally in technological advance, are needed. Some useful action can be:

- development of high speed ships, to reduce the gap with road in terms of time; even if competition between faster and more expensive road haulage and a slower and cheaper SSS rely solely on the value of time for the user;
- new vessels and advanced flexible ship designs to better integrate SSS (namely with high speed ships) within logistic chains;
- harmonisation of standards for information and communication technologies (ICT) and development of "community systems" to reduce costs of information input;
- harmonisation of standards concerning cargo units (see above), to achieve higher occupancy rates and highly or fully automated handling techniques;
- research reducing polluting emissions of ships, like SO_2, namely by lowering the sulphur content in bunker fuel oils or equipping the ships with exhaust gas cleaning systems (see endnote 21).

Logistics strategies. The following logistics strategies can be considered to implement SSS in a multimodal context and which meet the findings of Paixão Casaca and Marlow (2005):

- adoption of a total quality-management philosophy;
- consider the transport chain from an integrative perspective;
- consider freight-forwarding a core competency;
- develop partnerships and alliances to provide door-to-door transport;
- think about the importance of inland clearance depots and terminals in order to create networks;
- make use of outsourcing and adopt a time-management strategies to comply with shippers' requirements.[65]

4. The European Short Sea Shipping Policy

4.1 European Union short sea shipping policies

Road increased modal share and its continued growth in freight (see Section 2) is leading European road transport systems into serious problems with regard to congestion and safety, and as a consequence environmental impact of road transport is causing public concern. Under the given conditions, the EU has been developing and supporting a more sustainable transport policy from economic, social and environmental viewpoints.[66]

Although the Commission addressed the issue of SSS in 1985 when proposing freedom in providing maritime transport services for cabotage and intra-EU trades, the matter was left behind until 1992. The 1992 White Paper released by the Commission considered that transport should adopt a holistic approach rather than one based on the individual characteristics of the modes especially when road freight transport is expected to grow by 60% until 2013. What was being asked was the development of collaborative attitudes between the different transport modes so that each one complemented the other in such a way that the efficient running of transport services was being promoted. Through this action, the Commission was trying to promote the development of multimodal transport services over the long distances in opposition to unimodal transport, namely road transport. However, if these actions are not truthfully supported by all actors, and in the absence of new policy measures, growth will be concentrated on road transport for both goods and passengers. Road is the only mode capable of offering the tailored logistics needs of transport users, and because stricter environmental rules regarding road transport are being implemented up to 2014 (the Euro V and Euro VI) to reduce the impact of road transport on the environment.

The shift of goods from road to underused transport capacity, in particular rail, SSS and IWW, became one the objectives of the European Common Transport Policy (see endnote 19). The Commission outlined future priorities based on the need to reconcile the demand for mobility with the requirements of the environment, in line with the principle of sustainable mobility. This Communication examines SSS potential contribution to the achievement of sustainable mobility. It includes a series of recommendations addressed to Member States, their regional and local authorities as well as the maritime industries themselves. It also includes ideas for actions which can most appropriately be undertaken at Union level. It is intended to seek the political support of the Council for these recommendations. In what concerns the revitalisation of SSS, the Commission embarked on a promotion programme.

In 1995, the first communication on SSS was presented by the Commission and it targets at bringing SSS to an equal footing with other modes of transport by focusing on three important areas: (i) improving the quality and efficiency of SSS services; (ii) improving port infrastructure and port efficiency; and (iii) preparing SSS for a wider Europe. The Communication presented an action programme embracing a comprehensive list of measures to be undertaken by the Commission, Member States government, local/regional authorities, port authorities and maritime industries players (see endnote 21). The reasons for enhancing SSS in the EU are (i) promoting the general sustainability and safety of transport, by providing an alternative to congested road transport, also in order to reach CO_2 target under the Kyoto Protocol; (ii) strengthening the cohesion of the community, facilitating connections between Member States and European regions, and revitalising peripherals regions; and (iii) increasing the efficiency of transport in order to meet current and future demand arising from economic growth.

A progress report from the Commission was presented in 1997 following a Council resolution on SSS. This report showed that improvements to SSS roundtables should be organised at a national level with the participation of all interested stakeholders so that the peculiar problems that affect SSS could be sorted out.[67] The 1999 Communication on SSS examined its potential in the framework of sustainable and safe mobility, its integration in European logistic transport chains, its image and existing barriers to the development of SSS. It recommends further action and identified three main reasons why SSS should be promoted at a Community level: (i) to promote the general sustainability of transport; (ii) to strengthen the cohesion of the community; and (iii) to increase the efficiency of transport in order to meet current and future demands arising from economic growth. In this regard, the Commission published a list of further actions (see endnote 13).

As an environmentally friendlier alternative to road transport, SSS must be integrated into the logistics chain, its links with other modes must be improved, and the quality of service must be closer to the customer's needs. Port installations should be organised in such a way so that they can match better the requirements of SSS. According to the Commission, firms should integrate SSS into door-to-door services; intermodal logistic chains should be created to attract cargo in the long term. The success of SSS relies on the cooperation and coordination of all stakeholders (i.e. public authorities, shipping operators, ports, forwarders, freight consolidators and logistics companies). Actions towards standardisation/simplification in administrative procedures of Member States are needed, and ports are encouraged to promote SSS within their commercial strategies.

In June 1999 the Commission acknowledged that SSS needed to become a truly intermodal door-to-door concept; an essential element in its development was its integration in the European logistic supply chains to fulfil its users' requirements and be perceived with a new dynamic image (see endnote 13). This second two-yearly progress report underlines that turnaround delays, infrastructure constraints and non-transparent charges are a relevant problem for SSS. It also suggests that (i) ports should consider to set up dedicated short sea terminals in larger ports and providing other specialised services to SSS; (ii) the obligations in some ports to use separate pilots could be re-examined where the ship's master is certified to carry out the pilotage on his own; (iii) administrative procedures should be standardised and simplified, since documentation required in SSS is more than for road transport; improvements are possible namely in a uniform acceptance of IMO FAL forms, delegation of tasks to one authority or to a third part, permission to start unloading ships before reporting procedures have been finalised, increased use of electronic data interchange; and (iv) incentives to research aiming at reducing polluting emissions of ships are recommended.

The 2001 White Paper on European transport policy for 2010 highlights the role that SSS can play in curbing the growth of heavy goods vehicle traffic, rebalancing the modal split and bypassing land bottlenecks and its development can also help to reduce the growth of road transport, restore the balance between modes of transport, bypass bottlenecks and contribute to sustainable development and safety.[68] The entire the strategy underlying the 2001 White Paper is based on the need to shift the balance between modes since road transport growth caused high congestion and environmental costs (see endnote 68). A specific chapter is dedicated to the development of MoS, where it is stressed once more that SSS is a real alternative to land transport, and that (i) certain shipping links, providing a way around major bottlenecks in land transport networks, should be made part of the TEN-T; (ii) regulated competition in ports must be implemented, through clearer rules for access to the port service market;[69] (iii) rules governing operation of ports must be simplified; (iv) one-stop-shops should be created to bring together all links in the logistics chain (consignors, shipowners, shipping, road, rail and IWW operators); and (v) advanced telematic services in ports should be developed in order to improve operational reliability and safety. Fortunately work has been done in this direction; electronic port clearance for vessels and goods is now possible at some ports and there is also an SSS guide to customs procedures. If the outcome of the MarNIS EU research project is implemented, much of the informational constraints that take place will disappear and most important it will be a valuable tool to implement just-in-time strategies in a port environmental level since ports will be able to manage much better the flow of ships arriving in port, and consequently, their capacity.

In response to the 2001 White Paper on the European Transport Policy and to the June 2002 informal meeting of the EU Transport Ministers held in Gijón (dedicated to SSS), the European Commission presented in 2003 an action programme for the promotion of SSS and to remove obstacles to its development. SSS has a high priority in the European agenda and therefore, barriers have been clearly identified, requiring different levels of actions at community, regional and national level. The action programme as presented by the European Commission in April 2003 consisted of 14 individual actions grouped into three broad categories, namely legislative, technical and operational categories.[70]

To monitor the progress achieved since 1999 in the light of the 2003 Programme for the Promotion of SSS, the Commission presented in 2004 a new Communication. While highlighting the obstacles it presented the achievements reached so far in the light of the 2003 action programme.[71] It is the view of the Commission that SSS has proven its ability to reach competitiveness levels normally attributed to road alone and pressure is being exerted on SSS to expand its full contribution towards alleviating current and future transport problems in Europe. While listing the most significant SSS developments at Community and national levels, it also lists the obstacles that still hinder SSS development faster. Like the 2003 communication, this one also refers to the MoS concept.

On 13 July 2006, the Commission adopted a mid-term review of the programme for the promotion of SSS. The review evaluates the results of the 14 actions introduced in 2003 to enhance the efficiency of SSS in Europe and mentions that SSS is still growing, that numerous obstacles still hinder SSS and that some of the original measures should be retargeted to put the MoS concept in operation by 2010. It examines the possibility of extending the scope of SSS promotion through its integration in multimodal logistics supply chains in order to maintain the modern image that SSS has already acquired.[72]

The Blue Book on maritime transport released in October 2007, states that the Marco Polo and the TEN-T programmes will go on supporting the creation of MoS/ SSS networks.[73] The MoS/SSS differs from DSS, given the competition it suffers from land transport despite having lower externalities than land transport, having a high potential for maintaining European technological know-how in maritime transport and being a source of job creation.[74] In January 2009, the Commission updated its strategic goals and recommendations relatively its maritime transport strategy up to 2018 and once more reinforced its importance at a European level.[75] Reference is made to the adoption of positive measures that support SSS to increase sea exchanges in all the European maritime façades. These measures will include the creation of a European maritime transport space without barriers the full deployment of the MoS but also the implementation of measures for port investment and performance.

In this regard and in sequence of the 2006 mid-term review the Commission presented a Communication and an action plan to establish a European maritime transport space without barriers, whose objective is to eliminate or simplify administrative procedures in the intra-EU maritime transport, given the role that short sea shipping can play in the intermodal freight logistics chain[76] and a proposal for a Directive on reporting formalities for ships arriving in and/or departing from ports of the *Member State*s, thereby repealing Directive 2002/6/EC which met the changes of Community legislation and the FAL Convention.[77] More recently, in March 2009, the Commission reviewed the 14 actions presented in the 2003 Programme for the Promotion of SSS and its main conclusion is that SSS is far from being fully integrated in the door-to-door supply chain.

4.2 European Union general transport policies

Besides the dedicated SSS policy released by the Commission, the EU has been releasing some general transport policies that influence SSS. The liberalisation of domestic transport markets which allows free access to EU operators in cabotage transport of all Member States is certainly the most relevant concrete action that caused higher competition at lower prices. With the relevant exception of the Greek Islands, the internal market has been liberalised since 1 January 1999 under Regulations 4055/1986 and 3577/1992.[78]–[79] Other guidelines that have been developed are potentially relevant to SSS. The trans-European transport network (TEN-T) approved in 1996,[80] concerning infrastructure planning is a tool to enhance the domestic market and the perspectives of the EU enlargement: ports, originally not included in the TEN-T framework, have been subsequently integrated[81] and today, the TEN-T framework is ruled by Decision 884/2004/EC.[82] The regulations on infrastructure financing and pricing should limit distortions favouring road transport and push for a fair competition between transport modes. The liberalisation of the IWW market is expected to help SSS to become a link of the intermodal chain. The implementation of equitable behaviours in the field of environment and safety are expected to create a level playing field. The harmonisation/ liberalisation processes should increase the efficiency in all transport modes, proportionally more for those less liberalised so far (such as rail and sea transport), compared to road haulage.

The 2007 Commission's Communication on a European ports policy[83] within the broad European strategy of keeping freight moving aims at a creating a port system capable of coping with the future challenges of European transport needs. The 1997 Green Paper on ports and maritime infrastructure had already urged some measures, *inter alia*, links between ports and TEN-T, enhancement of ports' role in the intermodal chain, transparency of prices, and the adoption of a strategy based on the user pays principle, which are relevant to the development of SSS.[84] From another viewpoint, other political and environmental options, such as the goal of reducing road congestion and external costs of road haulage, are clearly able to positively influence the market for SSS. Also Psaraftis quoted in Papadimitriou (2001) acknowledges that SSS is regarded as a key factor of European economic cohesion and proximity between regions, namely between West and East Europe and highlights the importance of setting rules for a fair competition between transport modes, through infrastructure pricing and financing, and internalisation of external costs (see endnote 12). Papadimitriou also underlines the well-known and already mentioned problems in developing SSS (costs and times of ports nodes, inadequate intermodal integration, complexity of procedures, costs of the additional breaks of bulks, lack of transparency, inadequacy to requirements of just-in-time) (see endnote 12).

5. Conclusion and Further Comments

Even though the worldwide coastal shipping is very important and plays a key role in the distribution of goods, the European SSS has reached a high development stage in the world, and other geographical areas such as the United States, Canada, and Australia countries are looking at what is being done at the European level. A significant share of the European SSS traffic is concentrated in the Baltic and

North Sea, but it is in the Mediterranean that the best examples of SSS can be found. Despite this, there are still opportunities for further development in the Ro-Ro and container market segments. SSS growth is mainly related to captive markets caused by geographic/infrastructure constraints, by feeder traffic for hub-and-spoke deep-sea transport, by smaller ports' hinterland and in this regard it can hardly compete with surface transport, namely road haulage, when both land and sea links are available between origin and destination. Nevertheless, this business area is the most important one for policy makers facing the problems of growing congestion and high environmental and infrastructure costs of land transport.

Nevertheless, the European SSS fleet has a big problem concerning its high average age, which the absence of legislative measures enforcing the renewal of the fleet has contributed to it. Short sea operators do not possess sufficient funds to embark on a short sea fleet renewal programme, – the costs of building a small ship are high, and bank credit is very expensive. The resultant reduced profitability is a serious strategic concern in capital intensive companies planning for growth and the renewals that have taken place result more often than not from the existing rivalry between shipowners operating in this market, from port state control inspections and the enforcement of important legislation to protect the environment. The point is that new ships are needed to compete with road transport on cost, speed, flexibility, reliability without jeopardising safety and the environment, attractive sailing times, maintained transit times, and guarantee of delivery.

There is wide interest about critical factors in competition between SSS and land transport. As shown in Sections 2 and 3, low competitiveness is sometimes due to geographic characteristics (too-short distances between origin and destination, a bad ratio of maritime distance to land transport distance) or to demand characteristics (types of goods, volumes, etc.). Yet, low competitiveness is often due to supply factors concerning either SSS or competing modes where it is both possible and desirable to intervene, since they do not come from a fair competition between modes, but from imbalances in the costs of different modes, namely external costs; infrastructure costs, pricing and subsidisation; and transaction costs due to conditions outside the market (e.g. administrative/custom regulations, etc.).

Actions are being planned by a few Member States, where the domestic market is more relevant and where the sector is important from a national policy perspective, and by the EU, to the extent that efforts are being undertaken by experts and policy makers to remove distortions that prevent fair competition between modes, or at least to attain a more balanced modal split. The proposed measures include those outlined in Section 3 (including infrastructural, organisational, pricing, commercial, regulatory technological and logistics measures) which aim at ensuring a smooth transit of goods in ports; integrate SSS in intermodal logistic chains; draw generalised costs as near as possible to the real cost of transport (including external costs, energy and infrastructure), equalising the level of cost externalisation in the different modes, through both internalisation of environmental costs and the financing of infrastructure. However, so far, researchers and policy makers have just agreed, with few exceptions, that developing SSS is desirable and the first effective actions are now being implemented. The remarks that follow about changing scenarios might be useful to assess the potential effectiveness of future policies.

The huge outsourcing of logistic functions shows that logistics, while remaining highly strategic for firms, become more and more specialised. Its complexity in the era of globalisation requires higher quality and efficiency in transport activities. The need for distribution networks and the consequent, relevant scale/networks economies should be favourable to SSS only if it is able to fulfil higher and higher requirements in terms of quality standards (speed, punctuality, reliability). Otherwise, the need for speedy door-to-door, just-in-time services will be better matched by road haulage, despite higher transport costs per unit. Transport monetary costs are just a (small) part of the overall logistic cost, what makes it difficult to attract traffic flows on a low price basis (see endnote 3).[85] The strategic role of logistics implies that the quality elasticity of the demand (for logistic/transport services) is much higher than price elasticity. The outsourcing of logistic functions can be for SSS either an opportunity or a threat.

In the global market, control of logistic flows has become a crucial competitive advantage. Transport is part of a set of services that must match the logistic needs of the shippers. Network economies influence the geographic organisation of logistic operators. This means that potential for SSS is also related to the ability of ports to act not only as transhipment sites but as nodes of value-added services and logistic functions. The integration of a port within a (infrastructure and service) network becomes more important than the traditional concept of port hinterland. A proactive role of ports in integrating different links of logistic chains clearly becomes a key issue for SSS.

With fair competition between modes, there would be opportunities for a further growth of SSS, since its overall costs are comparatively low. The goal must be internalising both environmental and infrastructure costs in the prices paid by the users (user pays principle). Higher regard for the environment may lead to policies on road transport which will make the ratio of costs for users more favourable to maritime transport, so that relevant flows would shift from road to sea, starting with dangerous goods. The ongoing research is producing significant results in reducing pollution and noise and increasing the safety of road transport. Therefore, it is not sure that road transport will still be so little sustainable as it has been so far. Dire problems in the public finances of most developed countries (which normally have both a developed infrastructure network, and high levels of public expenditure for social/welfare issues) should result in lower public aids to infrastructure financing. Besides, improving land networks becomes more and more difficult because of territorial and environmental problems. The growing rigidity and cost of transport infrastructure is thus a major opportunity for developing SSS (apart for the need to increase port capacity). Regulations on infrastructure public financing and pricing should reduce present inequalities.

Too much attention may have been paid on SSS competitiveness relatively to road haulage. In the future not only SSS-based intermodality will compete with road transport, but also rail-based intermodality, namely with the development of high-speed railways. SSS and rail can be direct competitors, unlike today where low competitiveness of rail is due to technologic and managerial backwardness. Also, international integration, namely in the EU context, could promote easier procedures and techniques in land transport (harmonisation of railways technologies and standards, development of rail freeways). It may be meaningful that among new intermodal technologies which are being developed in order to reduce costs and times of transit in intermodal nodes, most are tailored on road-rail intermodality (swapbodies, piggyback, bimodalism) and only a few can help SSS-based intermodality (e.g. palletwide containers).

It has been shown that SSS market contestability is crucial. Strictly speaking, the market appears to be contestable since there are no barriers to entry or to exit, and incursions are possible from new entrants operating on other SSS routes (although slightly less from DSS because of differing ships' size). Thus, liberalisation should be desirable. Yet within logistic networks contestability can be jeopardised by operators with dominant position on the whole chain (see endnote 3). Big maritime carriers influence more and more intermodal networks, ports and logistic platforms at the regional/continental level. Vertical integration may give, namely in the feeder traffic, a low level of competition, which could spread on the infra-regional SSS market, because of probable economies of scope. Also, vertical integration of supply chains will require alliances/mergers between SSS operators and other carrier or terminal operators, particularly if the MoS concept is put in operation by 2010 as desired by the Commission.

It is presently highly uncertain if the elasticity of transport demand to gross domestic product (GDP) will still be so high in the near future. The potential for a revival of regional development/trade patterns is presently being investigated, namely after that (i) some excesses of globalisation bring about relevant externalities and inequalities; (ii) diffusion of economic growth makes it more and more difficult to exploit cheap inputs, and firms' requirements are shifting from cheap inputs to efficient infrastructure and public utilities, technological skills, legal and political reliability, etc.; and (iii) the present financial and economic crisis is showing the social problems that a globalised economy can cause. A possible revival of intra-regional growth and trade patterns would be an opportunity for SSS.

It is very difficult to forecast whether SSS opportunities will overcome the threats, and if policy guidelines will be effective and helpful. The potential for SSS will depend both on the growth of transport and on the possible modal shift from land transport, which is in turn a function of a number of elements which are restraining its uninterrupted growth, like congestion and long-run capacity limits. Once developed beyond some relevant thresholds, the growth of SSS is likely to develop cumulative effects since average costs should decrease more than in land transport. As described in Section 4, the key issue in ensuring a fair level of SSS development is to neutralise the effect on modal shift of different levels of market failures, namely in the fields of external costs, public expenditure on a natural monopoly such as infrastructure networks, and oligopoly/monopoly within the maritime transport industry.

Consequently, a paramount role of economic policy has to be developed by states, unions of states and international organisations, not only in ensuring fair competition and free access to the market of SSS, but also in order to equalise the level of cost externalisation in different modes. Thus, there should be three major guidelines on the agenda of policy makers to fair competition within sea transport, through liberalising access to the market and harmonising regulations; between transport modes, through the harmonisation of regulations concerning public aids to transport (namely in financing infrastructure); and between transport modes, through the internalisation of external costs of transport.