

Output 3.2-3

Shipper needs in relation to multimodal freight transport services

Interreg Baltic Sea Region Project #R032
“Sustainable and Multimodal Transport Actions in the Scandinavian-Adriatic Corridor”

Work Package	WP3 - Multimodal Transport				
Activity	A 3.2 - Assessing offers and preconditions for multimodal freight transport in the Scandria@2Act partner regions				
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Output Description (Application Form)

Activity 3.2-3 will address transport buyers and their needs. The activity will update results of Scandria's "Shippers' behaviour" report to take into consideration the developments of the last five years and extend coverage to all project regions. It will include the review of existing publications on shippers' requirements in the region, the identification of major shippers and their associations and the solicitation of their views in relation to multimodal transport solutions through a questionnaire, direct interviews and possibly a stakeholder workshop.

Output Schedule

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	31.10.16	30.04.17	31.10.17	30.04.18	31.10.18	30.04.19
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Quality Criteria

- The **aim of this output** is to present the results of Activity 3.2-3, which focuses on shipper requirements in relation to intermodal transport solutions.
- The **geographical scope** of the report is identical to that of the Scandria®2Act project, i.e. the northern part of the ScanMed TEN-T core network corridor consisting of Germany, Denmark, Sweden, Norway and Finland.
- Due to the horizontal nature of the activity, the **target group** consists of all stakeholders in freight transport operations: shippers and forwarders, multimodal service providers, regional, national and European transport planning authorities, knowledge institutions and industry organisations. Project partners in Group of Activities 3.3 are also among the recipients.
- The **intended use** of the report is the provision of assistance in the design and implementation of integrated multimodal freight transport operations. More specifically, it offers insights on the priorities of the shippers and their views on a number of measures that have been proposed for enhancing intermodal transportation.

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Abbreviations

ATM	Air traffic management
BSR	Baltic Sea Region
CNC	Core network corridor
CO ₂	Carbon dioxide
EC	European Commission
EDI	Electronic data interchange
ERTMS	European Rail Traffic Management System
ETCS	European Train Control System
GHG	Greenhouse gas
GoA	Group of activities
GPS	Global positioning system
GSM	Global system for mobile communication
ICT	Information and communication technologies
IT	Information technologies
ITS	Intelligent transport system
LSP	Logistics service provider
NSB	North Sea – Baltic (core network corridor)
RFID	Radio-frequency identification
RIS	River information services
ScanMed	Scandinavian – Mediterranean (core network corridor)
SESAR	Single European Sky ATM Research
SSN	SafeSeaNet
TEN-T	Trans-European transport network
UDC	Urban Distribution Centre
VTMIS	Vessel traffic management information system

1 Executive summary

In supporting multimodal freight transport services, Activity 3.2-3 focuses on identifying the priorities of the shippers (cargo owners) in relation to intermodal logistics solutions that comprise the core of multimodality.

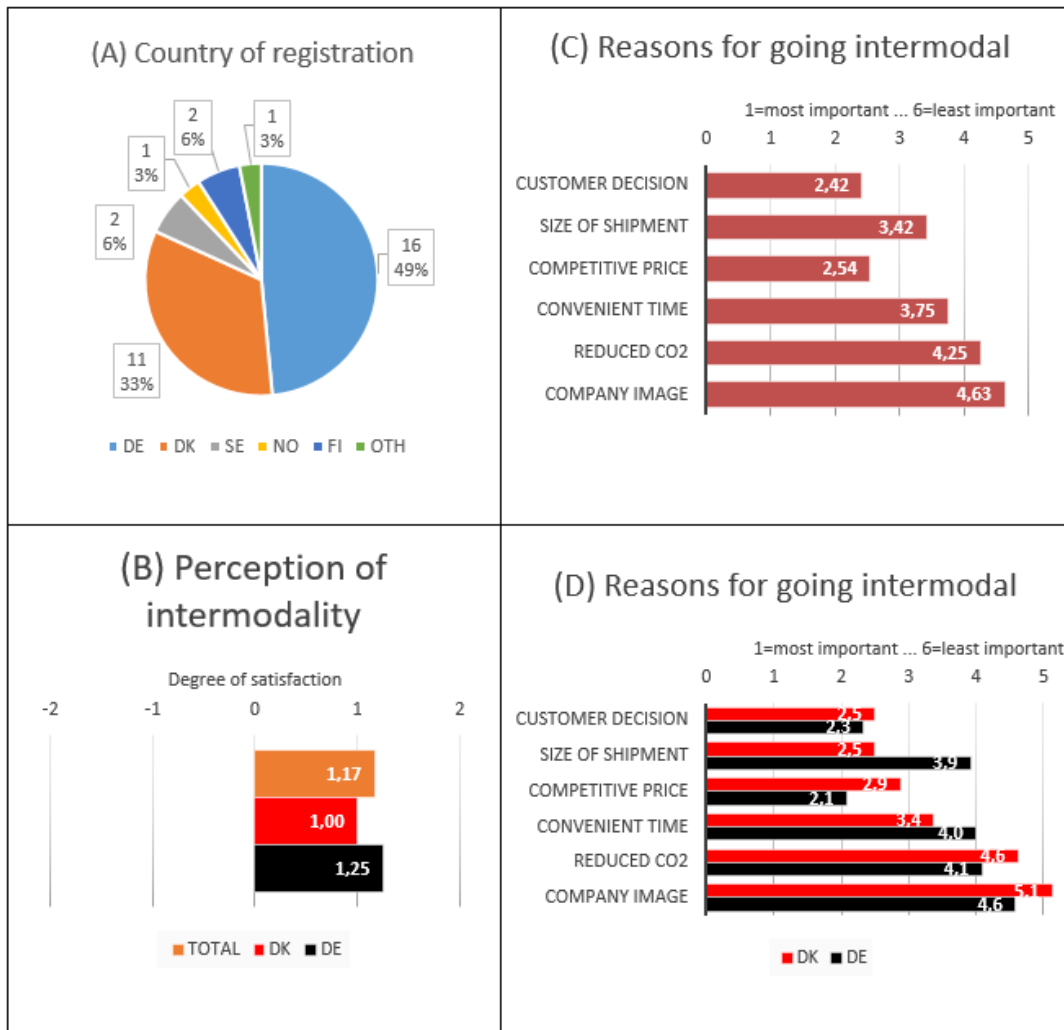
A literature search was performed on this subject. It identified a long list of characteristics that shippers consider necessary for efficient and effective intermodal transport. They include price, delivery time, time reliability of delivery, frequency of shipments, cargo safety and security, reliability of pick up time, ability to respond to customer needs, proactive notification of problems, etc. A number of pre-conditions were also identified. They include the commodity type, value, density and time-sensitivity, freight distance, direction of haul (head-haul/back-haul), meaningful load factors and transshipment costs.

Based on the results of the literature search, a questionnaire was designed for obtaining shippers' assessment of their experience with intermodality, the factors driving it and the measures proposed for its promotion. It is noted that the latter subject has not been treated by the previous studies examined. After being revised on the basis of feedback received from logistics experts, the questionnaire was promoted through shipper associations in the five study countries (Germany, Denmark, Sweden, Norway and Finland). Responses were received through an electronic survey lasted from July 2017 to June 2018. The questionnaire was also distributed in paper form to the participants of the event "Future transport and logistics in the Fehmarnbelt Region – How to be prepared for changing cargo flows" on 29 May 2018 during the Fehmarnbelt days 2018 in Malmö, Sweden. Furthermore, responses were enriched by a number of interviews from selected companies and associations.

The majority of the 33 usable responses obtained comes from Germany and Denmark. The companies that have arranged intermodal shipments during 2016 find their experience more than satisfactory. Germans appear to be 25% happier with intermodality than their Danish counterparts, who are still satisfied. The differential is greater with regard to business types. Freight forwarders, who are more exposed to intermodal realities than shippers, display a much higher satisfaction than the latter, who fall a bit short of the satisfactory level albeit still on the positive side.

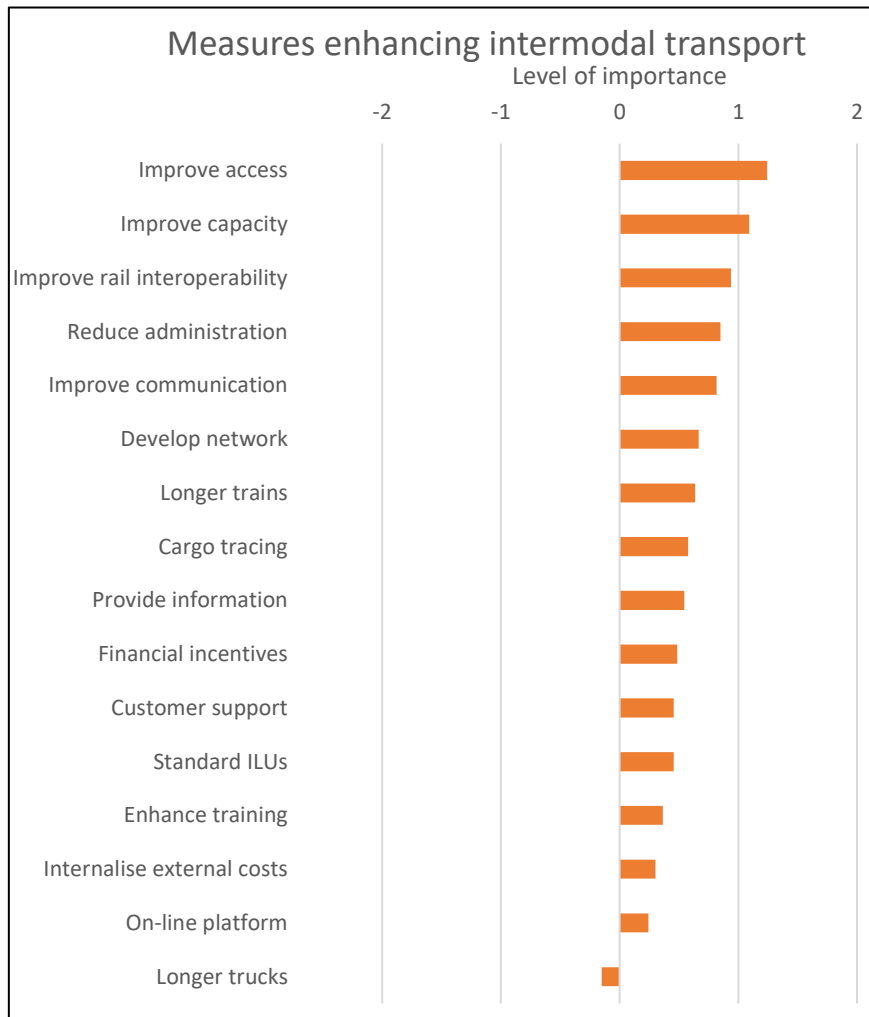
Among the reasons for going intermodal, the specific customer/supplier instructions appear to be the most important one. This finding suggests the need to identify the right decision-makers prior to designing activities promoting intermodal transportation. Competitive pricing follows suit surpassing all other quality characteristics (in Germany, it is even more important than customer preferences). This result contradicts the findings of other studies that assign more importance to attributes such as frequency of service, reliability, etc. The appropriateness of shipment size and the convenience of transit time follow price concerns in the scale of importance. It is interesting to note that the advantages offered by intermodality in terms of low emissions and improved company image appear very low in the importance spectrum despite the emphasis placed on them by the policy makers.

As expected, the type of business has a bearing on these priorities. Competitive pricing is the main concern of shippers, while from the freight forwarders' perspective, customer preferences remain the decisive factor. An interesting observation is that the only occasion that environmental concerns climb higher than shipment size and transit time is when it comes to other businesses, probably pointing to the more distant positioning of this type of respondents to the realities of the market place.



The literature search also led to a list of 16 measures that have been proposed for the advancement of intermodal transport. They are briefly presented in five groups:

- Capacity improvements (additional capacity of existing links/nodes; dense network of logistics centres; and better accesses to ports/terminals)
- Administrative/regulatory issues (interoperability improvements in the rail sector; standardisation of logistics units and transport vehicles including longer trucks/trains; and simplification of administrative burdens in the shipping sector)
- Information and communication infrastructure (stronger customer support; information on available services; cargo tracking and tracing services; communication within the supply chain; and on-line platform for cargo consolidation)
- Market-based measures (financial incentives to intermodal solutions; and internalisation of external costs of transport)
- Training in logistics.



All these measures received a positive response (above average importance) from the respondents with the exception of longer trucks (although weakly supported in Denmark). Infrastructural aspects enjoy the top two positions, namely the improvement of road and rail accesses to multimodal terminals/ports and the strengthening of the capacity of existing facilities/links. Addressing the interoperability problems of rail transport and the administrative/regulatory burdens of (mainly waterborne) transport are also given a lot of attention. Improved communication aiming at information exchange between all actors in the supply chain (e-freight, e-maritime, etc.) attracts the highest attention among the ICT-related measures, while in the market-based group, the provision of financial incentives to the users of intermodal arrangements is more popular than internalising external costs of transport. Neither the enhancement of training in logistics is very high in the priority list.

Freight forwarders are much more sensitive than shippers in issues such as improved accesses to ports and terminals, higher density of the logistics centres network, adequate cargo tracking and tracing services, enhanced training in logistics, improved communication within the supply chain and the provision of financial incentives for intermodal solutions. Shippers, on the other hand, wish better customer support and are not very keen in internalising external costs, which seems to be a major concern for the group of other businesses.

2 Introduction

The report presents the work performed and the results achieved under Activity 3.2-3 of the Scandria[®]2Act project. Scandria[®]2Act is an initiative of regions located along the Scandria[®] corridor, i.e. the Baltic Sea stretch of the Scandinavian-Mediterranean core network corridor. It aims at increased connectivity and competitiveness while reducing the negative implications of transport operations.

Aiming at removing physical, technical, operational and administrative bottlenecks along the major transport axes across Europe, the core network corridors (CNCs) were introduced in 2013 as an instrument for the coordinated implementation of the EU transport infrastructure policy. A major challenge in organising transport along the CNCs is the negative environmental impact caused by emissions mainly of road transport and the limited capacity of transport infrastructure in highly utilised corridor sections.

The Scandinavian-Mediterranean (ScanMed) is one of the two CNCs that surround the Baltic Sea Region (BSR); the North Sea-Baltic (NSB) being the other one. The transport market study of the ScanMed corridor identified a number of bottlenecks already existing in the transport network and confirms rising transport volumes between the corridor regions. This puts high pressure to develop cross-sectoral and cross-level solutions that minimise environmental impact of transport and optimise capacity utilisation. This is the challenge that Scandria[®]2Act addresses and to which Activity 3.2-3 contributes.

2.1 The Scandria[®]2Act framework

To meet its objective, Scandria[®]2Act has adopted a 3-tier approach addressing:

- the deployment of clean fuels,
- the deployment of multimodal transport services and
- the establishment of a multilevel governance mechanism, the Scandria[®]Alliance.

The promotion of multimodal transport of both passengers and freight along the Scandria[®] corridor is the subject of the project's WP3. More specifically, the package aims to:

- improve knowledge about transport flows in the corridor as a prerequisite for increasing capacity of regional stakeholders to adopt relevant policies,
- facilitate multimodal transport services that are capable of shifting freight volumes from road to other, less burdening transport modes and
- strengthen existing services in passenger transport by providing relevant information about international public transport services to customers.

Against this background, the Group of Activities (GoA) 3.2 aims at identifying the current offers of multimodal freight services in the region and investigating the necessary preconditions for enabling their advancement. The group consists of four distinct activities:

A3.2-1: Map the current services offered to/from the partner regions,

A3.2-2: Assess the stability of the Ro-Ro offers in the region in view of the recent regulations restricting the sulphur content of marine fuels,

A3.2-3: Investigate the shipper needs in relation to multimodal freight transport services and

A3.2-4: Identify appropriate business models for multimodal services along the corridor.

2.2 Activity objectives

Modal integration concerning infrastructure, information flows and procedures can contribute significantly to the enhanced efficiency and effectiveness of transport. As such, it is an old quest for the European transport policy. Already in 1997, the Commission argues "...the challenge is to organise seamless and customer-oriented door-to-door transport services which draw on the strengths of all modes and which make use of all transport infrastructure and capacities" (EC, 1997). More recently, the latest White Paper on transport (EC, 2011) considers modal integration as a main characteristic of service quality, in addition to attractive frequencies, comfort, easy access and reliability of services.

Intermodality, defined as the use of standardised load units such as standard shipping containers, swap-bodies or trailers, is critical for integrated logistics solutions, as it eases transshipment across modes and significantly reduces the related costs. Shifts from road to intermodal chains is seen by many as a means to by-pass congested areas and/or routes of limited capacity and improve the environmental performance of freight transportation with regard to greenhouse gas (GHG) emissions (e.g. Janic, 2007).

To foster intermodal transport, however, it is necessary to understand the decision-making process followed by the shippers and the freight forwarders. A number of studies have been undertaken in this area in the past, including one by the Scandria[®] project, the predecessor of Scandria[®]2Act, entitled 'Shippers' behaviour' (Michalk, 2011).

Activity 3.2-3 will update the results of the Michalk (2011) report to take into consideration the developments of the last five years and extend coverage to all project regions. It will include:

- a review of existing publications on shippers' requirements in the region,
- the solicitation of shipper/freight forwarder views in relation to multimodal transport solutions through a questionnaire,
- the analysis of feedback received augmented by interviews, and
- the presentation of the findings.

2.3 Structure of the report

The next section is devoted to the review of selected literature on the attributes of freight transport that are important to the decision makers, i.e. shippers and freight forwarders. The priorities among them are identified and compared. The purpose is to identify the qualities against which intermodal solutions are being assessed in the market place.

Section 4 presents the results of our own investigation on the same question. Priorities are further analysed by the type of decision maker and the country of registration. The section also assesses the degree of satisfaction that the respondents have had with their intermodal transport experiences. Comparisons across business types and countries are similarly presented.

Section 5 focuses on a collection of measures that have been proposed for enhancing intermodal transport. Measures concerning the areas of infrastructure capacity, the regulatory/administrative framework, the use of ICT applications, the introduction of market-based measures and the enhancement of training on logistics are assessed by the decision makers and their perceptions are analysed by business type and country of registration.

The conclusions of the report are summarised in Section 6.

2.4 Acknowledgements

This activity is co-funded by the Interreg Baltic Sea Region Programme 2014-2020 and the Department of Management Engineering of the Technical University of Denmark. We are grateful to both. We also



express our gratitude to the Scandria®2Act management team, Dr. Ulrike Assig, Horst Sauer and Sven Friedrich for entrusting this activity to us. Special thanks are due to our WP3 colleagues Sorin Sima, Thomas Brauner, Lovisa Uhlin, Dino Keljalic and Lauri Ojala for their assistance in bringing us in contact with their networks, and their constructive comments on the earlier versions of this report. We are also indebted to all our interviewees for taking the necessary time to respond to our written and verbal questions, as well as to all respondents to our questionnaire for their valuable contribution.

3 Shipper requirements

3.1 General literature survey

The characteristics of intermodal transportation that shippers consider necessary have been a popular research topic for many years. As early as in 1991, Fowkes et al. investigated the potential for intermodal freight services in the British market. They used a stated preference methodology that takes into consideration **price, delivery time and reliability of delivery**. Their results show that the use of a 40-foot dry container can be profitable over a distance of 400 miles but only when the product is dense enough for the container to be constrained by weight. Similar results were obtained for tank containers carrying bulk liquids. With the possible exception of the main London-West Midlands-North West-Scotland corridor and the trade with continental Europe through the Channel Tunnel, they found very limited scope for intermodal services within Great Britain (Fowkes et al., 1991).

Cullinane and Toy (2000) applied a content analysis methodology to the freight route/mode choice literature for the identification and justification of the attributes that are utilised within stated preference experiments. They ranked freight journey attributes according to the cumulative/collective importance placed upon them within the existing literature. They concluded that the five factor categories most often considered in the freight route/mode choice literature are: (i) **cost/price/rate**, (ii) **speed**, (iii) **transit time reliability**, (iv) **characteristics of the goods**, and (v) **service** (unspecified).

Bunker and Ferreira (2002) examined the modal split of freight movements along the Brisbane - Cairns corridor in Queensland, Australia. They identified a limited number of explanatory variables used in freight transport mode selection (from most to least common): **freight charge; transit time; reliability (on-time performance); commodity value; and commodity density**. Furthermore, when it comes to assessing transport suppliers, customers typically consider the **reliability of delivery (on-time); care of goods; reliability of pick up (on-time); ability to respond to customer needs; and proactive notification of problems**. They concluded that selection depends on the specific freight tasks. Rail dominates the long distance bulk market. Road and rail compete for the long distance non-bulk market, although road has a significantly higher market share due to service flexibility and reliability. The urban and middle distance non-bulk market is dominated by road due to its flexibility over rail and significantly better time performance.

Garcia-Menendez et al. (2004) applied a conditional logit model to estimate freight transport demand for road and sea services generated by exporting firms in the Spanish region of Valencia. This revealed preference study emphasised the role of **cost, transit time, and frequency of shipments** as determinants of modal choice. In addition, **transport quality** emerged as a crucial determinant for certain sectors such as ceramics. They concluded that for a given shipping or road attribute, the elasticity of choosing shipping is always larger than the elasticity of choosing road, meaning that maritime transport is more sensitive to variations in haulage prices and economic policies.

Janic (2007) introduced the **environmental and societal costs** (i.e. local and global air pollution, congestion, noise pollution, and traffic accidents) in the modal choice discussion and investigated the effects of internalisation of external costs of transport on the competitive position of road and intermodal (road/rail) transport in Europe. His results show that the full costs decrease more than proportionally as the door-to-door distance increases; suggesting economies of distance.

Building on previous empirical evidence suggesting that the criteria shippers use in the Nordic regions of Europe for route and mode choice are mainly '**operational excellence**' (referring collectively to **efficiency, reliability, expediency, and service**), **service availability**, and **risk to cargo**, Nair et al. (2008) examined the market potential of a rail-based corridor spanning from the Baltic to the Mediterranean. A generalised cost function was used for determining the choice between truck-only paths and rail-based intermodal paths. Each path had associated attributes considered explicitly by the

- Transport time in intermodal transport is usually longer than in classic road transport
- Intermodal transport is less reliable if a national border needs to be crossed; it is however at least as reliable as road transport, if no national borders are being crossed
- Intermodal transport requires large load volumes to make a train economical feasible
- Transport distances usually need to be longer than 300 km to make intermodal transport feasible
- A lack of knowledge and experience in intermodal transport on the forwarder side is a significant obstacle for the use of this transport type
- Freight forwarders and shippers often lack knowledge on or understanding of governmental stimulation schemes
- Forwarders are more likely to organise an intermodal transport chain, if they have a cooperation partner in the receivers region. The lack of a cooperation partner is therefore an obstacle to intermodal transport
- The perceived lower flexibility in terms of frequency and fluctuation in shipment sizes can be an obstacle for shippers to use intermodal transport.

In ranking the importance of the difficulties that rail transport faces, the study refers to the results of previous works that are summarised in Figure 1. It is interesting to note that service quality characteristics such as transit time, lack of flexibility and insufficient customer support score much higher than price.

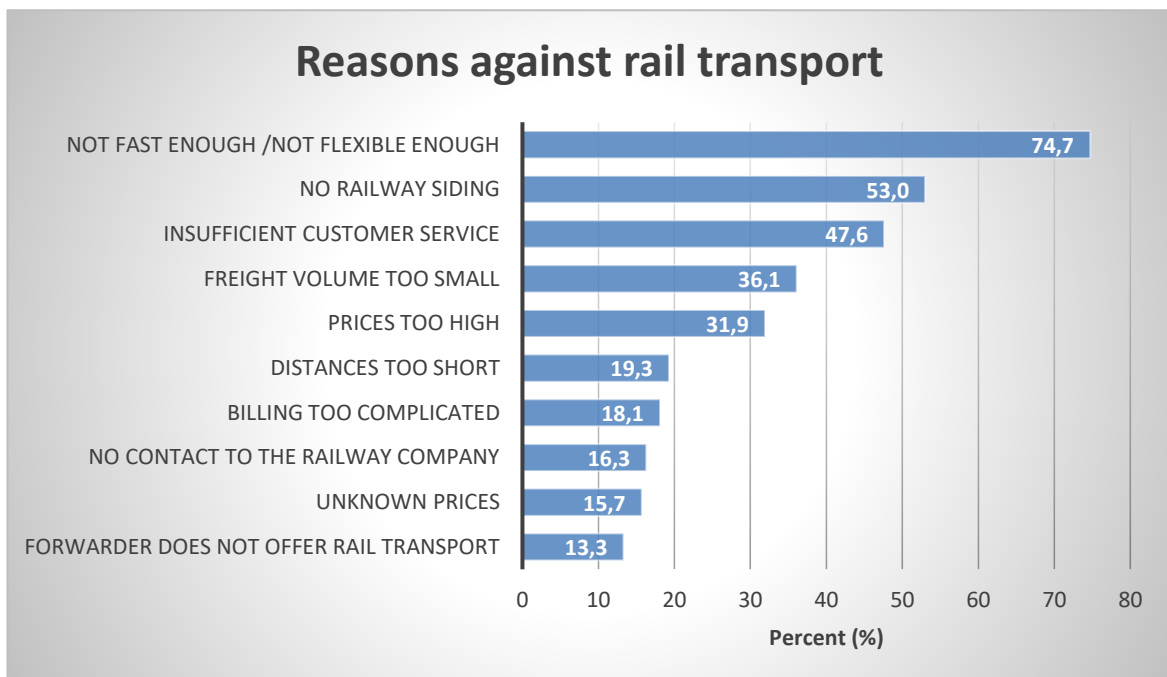


Figure 1. Ranking of reasons against rail transport
(Source: Own compilation based on Michalk, 2011)

The Scandria® study concludes with the suggestion of the following potential measures that address the identified problems:

- (i) Create a new rail network product that allocates higher priority to intermodal freight trains (along the lines of the Rail Freight Corridor network of Regulation (EU) No 913/2010)

- (ii) Implement the European Train Control System (ETCS), the signalling and control component of the European Rail Traffic Management System (ERTMS), to advance the cross border reliability
- (iii) Develop a platform around an IT-tool enabling the exchange of information on existing intermodal services and their main attributes such as transport time, time window, price, CO₂ emissions, etc.
- (iv) Organise a dedicated network for the dissemination of promotional material such as documents on the advantages of intermodal transport, best practices, guidelines for using existing services, and lists of potential cooperation partners in various regions.

3.3 The NSB CoRe study on logistics requirements

A more recent study on this subject albeit with a different geographic scope was undertaken by the sister NSB CoRe project (Rehse and Schlächter, 2018). The aim was to obtain a better knowledge of the main barriers of intermodal transport along the NSB corridor, as well as to investigate business opportunities arising from the new intermodal infrastructure, especially Rail Baltica. The part of the report that is more relevant to our work concerns the identification of the main goals and needs of the logistics service providers and shippers along the corridor, together with their main challenges, opportunities and priorities.

The study is based on a series of 225 interviews with companies from the private sector of six countries (Finland, Estonia, Latvia, Lithuania, Poland and Germany), performed between January and September 2017. The sample consisted of 119 logistics service providers (LSPs) and 106 shippers. They were asked to assess the importance of 20 barriers organised in six categories. The barriers that each stakeholder type was asked to assess on a scale from 1 (no barrier at all) to 6 (very big barrier) appear in Table 1, together with their categories.

Table 1. Barriers assessed by each type of stakeholder

Category	Barrier	Freight forwarder	Intermodal operator	Rail carrier	Container terminal	Road carrier	Shippers
Cost	Not competitive towards road transport	X	X	X	X	X	X
	High fee for access to infrastructure		X	X	X		
Transit time	Long transit time	X	X	X	X	X	X
	Lack of reliability / schedule deviations	X	X	X	X	X	X
	Lack of flexibility						X
Security	Low security of cargo	X	X	X	X	X	X
	No track and trace service available	X	X	X	X	X	
Network	No adequate network (density)	X	X	X	X		X
	Lack of logistics centres nearby	X	X	X	X		
	No open terminals for every carrier		X	X	X		
	Different track gauge		X	X			
	Change of locomotives at borders		X	X			
	Inadequate frequency						X
Resources	Infrastructural bottlenecks						X
	Shortage of rolling stock		X	X			
	Shortage of multi system locomotives		X	X			
	Short. of qualified locomotive drivers		X	X			
Information	Small freight volumes						X
	Poor exchange of EDI messages	X	X	X	X	X	
	No information about connections	X	X	X	X	X	X

(Source: Rehse and Schlächter, 2018)

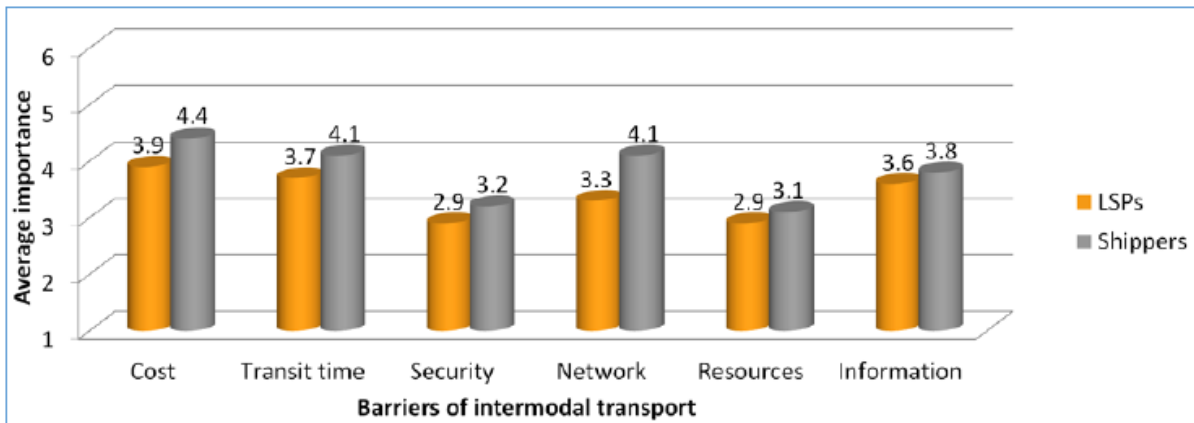


Figure 2. Importance of barriers as perceived by logistics service providers and shippers
(Source: Rehse and Schlächter, 2018)

Figure 2 presents the importance that the LSPs and shippers assign to each barrier category. In general, it seems that shippers are more critical of intermodal transport than LSPs, probably because they are less aware of such logistics arrangements than the service providers themselves. Cost appears as the barrier of highest importance for both groups of stakeholders, while resource and security concerns exhibit the lowest score.

Table 2. Ranking of barriers by type of stakeholder

Barrier category	Freight forwarder	Intermodal operator	Rail carrier	Container terminal	Road carrier	Shippers
Cost	4.2	4.0	4.0	3.7	3.7	4.4
Transit time	3.7	3.0	3.1	3.9	4.0	4.1
Security	3.0	2.7	2.1	2.3	3.1	3.2
Network	3.9	3.0	3.3	2.6	---	4.1
Resources	---	2.8	3.0	---	---	3.1
Information	3.8	3.1	3.6	3.3	3.7	3.8

(Source: Rehse and Schlächter, 2018)

The same information broken down by type of stakeholder appears in Table 2. The red colour signifies the most important barrier of each stakeholder, followed by orange and yellow, the second and third most important ones respectively. Once again, cost is the major concern of all stakeholders with the exception of container terminals and road carriers. This is an expected result for the latter group, as higher intermodal transport prices would create additional competitiveness gains for road haulage. The result is less obvious for the container terminals though, unless the terminals sampled are located in ports, where traffic is less sensitive to road/rail cost differentials. Both these types of stakeholders are mostly concerned with time-related aspects such as length of transit time and reliability/flexibility of delivery. Another interesting result of Table 2 is the relatively high importance that all five types of LSPs attach to information-related barriers, meaning problems with the provision of information on intermodal connections and poor exchange of EDI messages.

The NSB CoRe interviews revealed some other important barriers not included in the list of Table 1. The most frequent among them relates to the so-called ‘last-mile’ leg, the cargo collection and distribution service at the beginning and/or the end of an intermodal door-to-door solution. Related difficulties expressed include the lack of information on the provision of last-mile services and the high cost

associated with these services in comparison to the long haul part of the chain. Other barriers mentioned relate to the unsuitability of certain types of cargo for intermodal transport and the inadequate access to intermodal transport in hinterland and peripheral regions.

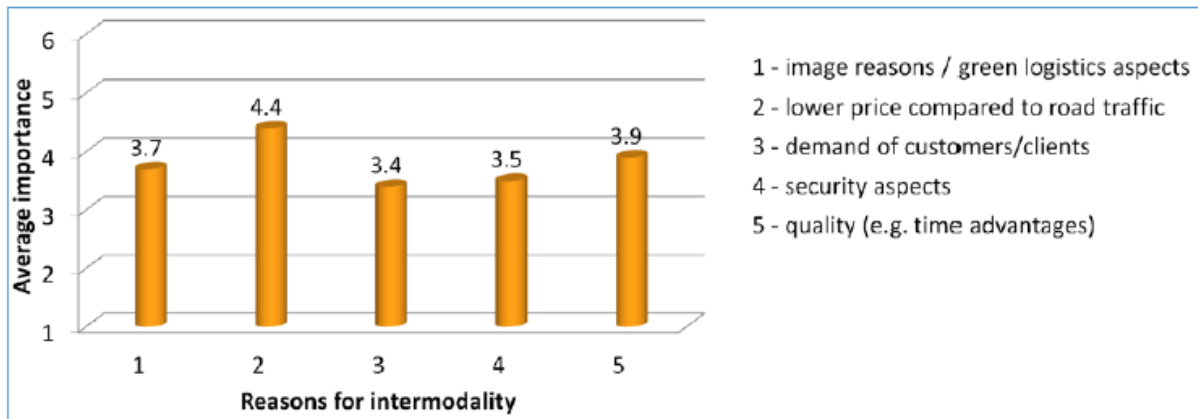


Figure 3. Advantages of intermodal transport as perceived by shippers
(Source: Rehse and Schlächter, 2018)

The NSB CoRe study also asked the shippers of the sample to assess five intermodality advantages on a scale 1 to 6 of increasing importance. The results of Figure 3 demonstrate price as the most significant factor for selecting an intermodal arrangement against an only-road solution. The quality of service with emphasis on the time dimension (length/reliability/flexibility) appears in the second most important position. It is interesting to note that these same factors appear also in the same order as the main barriers for intermodality. Image aspects related to the environmental performance of intermodal transport chains appear in the third position, higher than safety/security and customer requirements. The role of intermodality in addressing road congestion was also mentioned by several shippers in addition to the characteristics listed in Figure 3.

4 Perception of intermodal transportation

The purpose of this section is to present the shippers' perception of intermodal transportation and the importance they attach to a number of intermodality drivers. A brief description of the questionnaire used for soliciting the respondent views and the composition of the sample are presented first.

4.1 The questionnaire and sample composition

A questionnaire was developed for obtaining the information needed for this task. It was based on relevant findings from the literature and previous studies. The first version of the questionnaire was tested by five logistics experts, one from each of the countries of interest (Germany, Denmark, Sweden, Norway and Finland). Based on their feedback, a final and much shorter version was designed targeting a response time of less than 10 min. The questionnaire, which appears in Annex A2, consists of four parts:

- (i) General information on the respondent for acquiring a picture of the sample, forming two distinct groups of respondents with supposedly different behaviours (shippers and freight forwarders), and for separating respondents with intermodal experiences from those without
- (ii) Questions to companies with intermodal transport activity during 2016 for obtaining their general perception on such arrangements and their assessment of factors seen as advantages of intermodal solutions
- (iii) Questions to companies with no intermodal transport activity during 2016 for identifying features that work against intermodality
- (iv) Questions to all companies for soliciting their views on measures proposed for the promotion of intermodal transport, and for identifying other issues of interest.

The first two parts of the questionnaire are analysed in this section, while the results of fourth one are presented in Section 5. The third part of the questionnaire produced results of limited value and are not pursued further here. The terms used in the questionnaire and the analysis are defined in the glossary of Annex A1.

The questionnaire, in both paper and electronic form, was sent to shipper associations in the study countries with the request to forward it to their members. The electronic survey remained open during the period July 2017 to June 2018. It was also distributed in paper form to the participants of the event "Future transport and logistics in the Fehmarnbelt Region – How to be prepared for changing cargo flows" on 29 May 2018 during the Fehmarnbelt days 2018 in Malmö, Sweden. Responses were enriched by a number of interviews from selected companies and associations.

A total of 33 complete responses entered the sample, the composition of which is shown in Figure 4. In terms of business activities, 14 responses were received from freight forwarders and 9 from shippers. The remaining 10 entries originate in universities and transport companies (terminal operators, railway operators, ship operators, agents, etc.).

Almost half (16) of the respondents come from legal entities registered in Germany, followed by 11 Danish establishments. Sweden and Finland participate in the sample with two respondents each, while one response comes from Norway. We also received a response from an unspecified other country.

Large companies with more than 250 employees represent 40% of the sample, the remaining being almost equally split among very small (<10), small (11-50) and medium-sized (51-250) companies.

The composition of the sample in terms of the positions held by the respondents in their affiliations appears in Figure 4(D). We have 4 General Managers (GM), 4 Operations Managers (OM), 7 individuals

from sales/purchases (SAL) and 8 from the logistics department (LOG), the remaining coming from other positions.

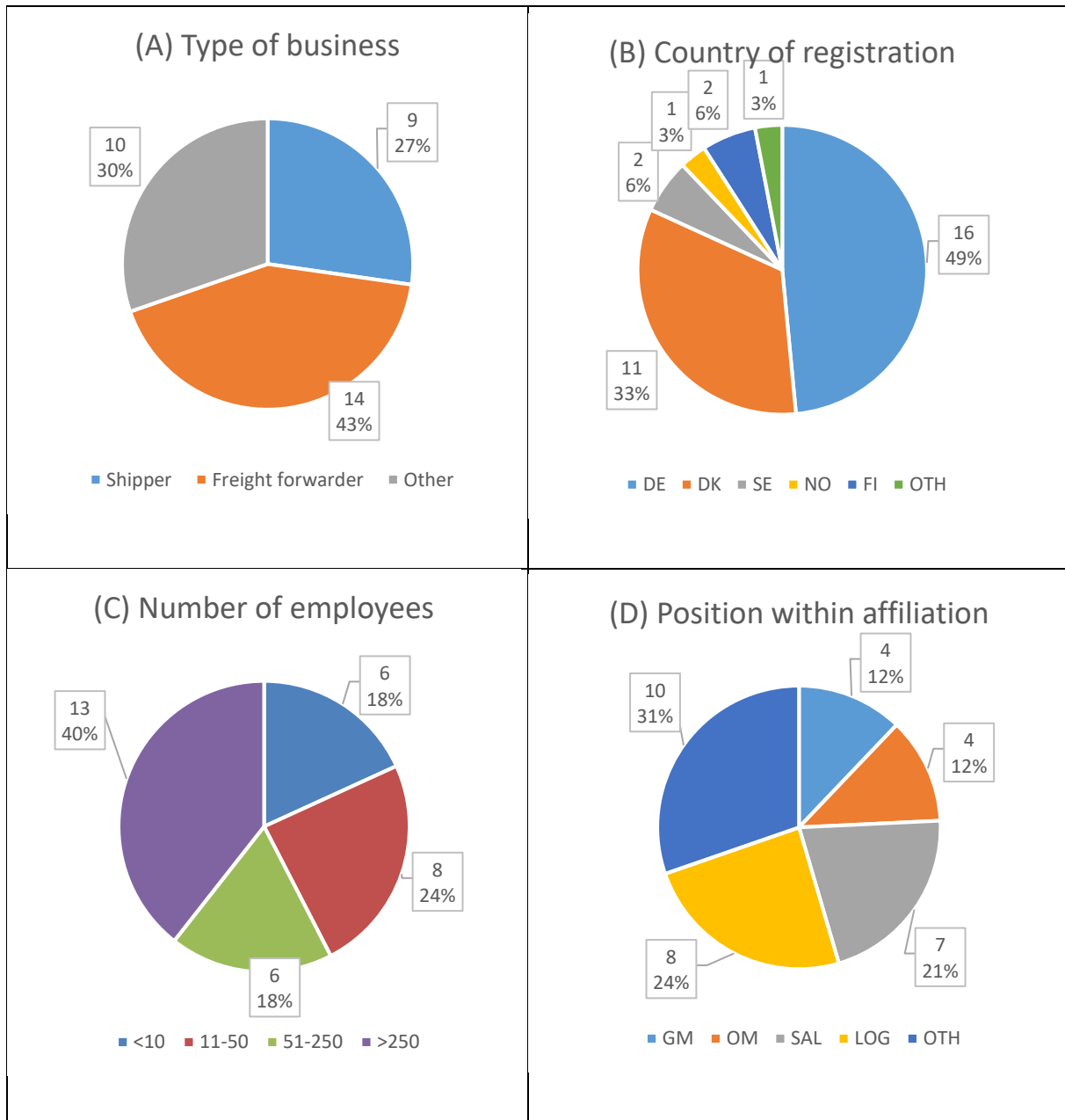


Figure 4. Sample composition
 (Source: Own compilation)

4.2 Overall perception of intermodality

A 73% share of the sample (24 respondents) replied positively when asked if they had arranged during 2016 at least one intermodal shipment to a location more than 300 km away. These companies were subsequently asked to indicate their general degree of satisfaction with the intermodal solution they had tried on a 5-point scale ranging from -2 ('very disappointed') to 2 ('very satisfied'). The results appear in Figure 5.

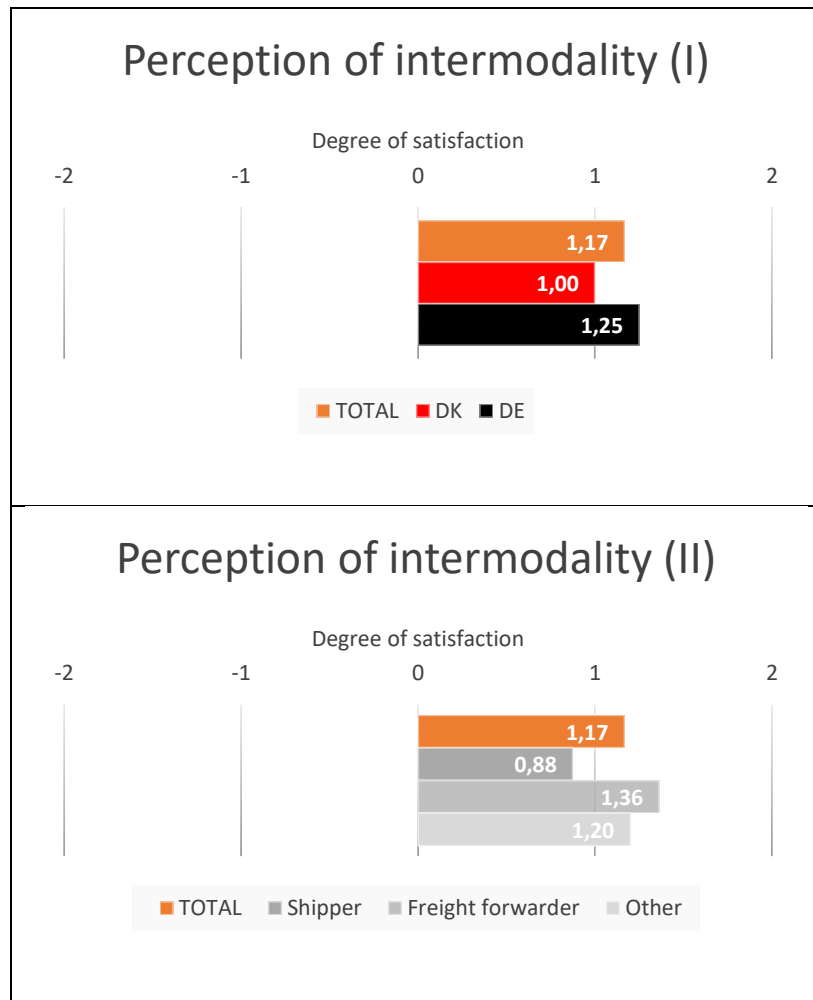


Figure 5. Overall perception of intermodality by country of registration and type of business
 (Source: Own compilation)

With an average score of 1.17, the sampled companies find their intermodal experience as more than satisfactory. The upper part of Figure 5 shows the average scores of the Danish and German companies (no average figures are displayed for the other countries due to low number of entries). It seems that Germans are 25% happier with intermodality than their Danish counterparts, who are still satisfied. The differential is greater with regard to business types. Freight forwarders, who are more exposed to intermodal realities than shippers, display a much higher satisfaction than the latter, who fall a bit short of the satisfactory level but still on the positive side. In fact, this profession-related differential might partly explain the geographic one, as the ratio of freight forwarders over shippers in Germany is 2.67 against 1.00 in Denmark. The other businesses score very close to the general average.

4.3 Importance of intermodal drivers

The same 24 respondents of the previous section (with intermodal experiences) were asked to rank the following five advantages of intermodal solutions in order of decreasing importance:

- Size of shipment
- Competitive price
- Convenient door-to-door transit time
- Reduced CO₂ (and other greenhouse gas) emissions
- Improved company image

An additional reason for selecting an intermodal arrangement was added to the list to cater for external influences in decision-making:

- Specific instructions from customer/supplier

The average scores attained appear in Figure 6. The inclusion of the last reason mentioned above proved a wise decision, as the specific customer/supplier instructions ended up in the top position, suggesting that often other actors in the supply chain select the logistics arrangements. This creates the need to identify the right decision-makers prior to designing activities promoting intermodal transportation.

Having said that, the driver of most importance is competitive pricing. This result contradicts findings of other studies that assign more importance to attributes such as frequency of service, reliability, etc. A possible explanation might be the business environment of fierce competition that characterises the freight logistics industry today and the high quality standards that customers have been accustomed to expect.

The appropriateness of shipment size and the convenience of transit time follow price concerns in the scale of importance. It is interesting to note that the advantages offered by intermodality in terms of lower emissions and improved company image appear very low in the importance spectrum despite the emphasis placed on them by the policy makers.

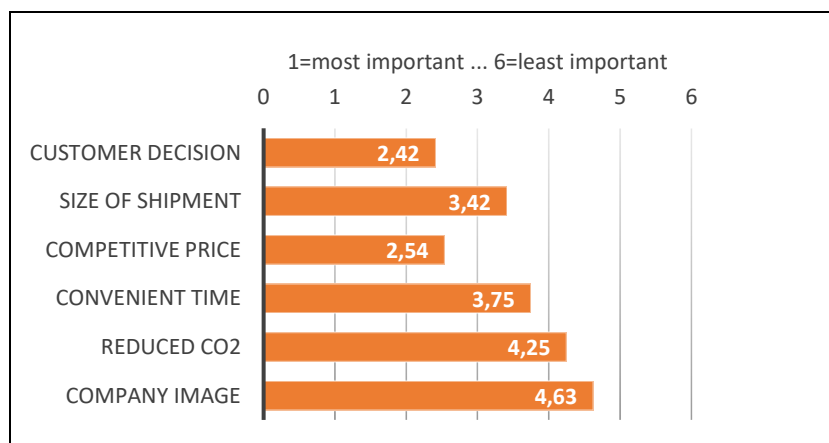


Figure 6. Average importance of intermodal drivers
(Source: Own compilation)

Figure 7 captures the geographic differences in this respect. In Germany, price escalates to the top position, even surpassing the factor of external decision-making. The interplay of market forces in this country is probably the reason behind this finding. In Denmark, on the other hand, the shipment size

becomes more important than price. This might be the result of the small distances that characterise this country, where other-than-road solutions are selected only when trucks simply cannot serve the trade due to cargo volumes.

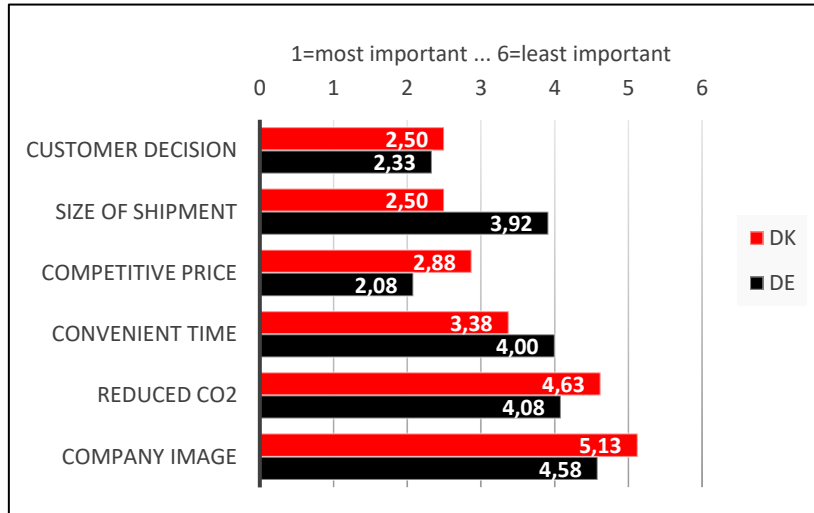


Figure 7. Importance of intermodal drivers by country of registration
 (Source: Own compilation)

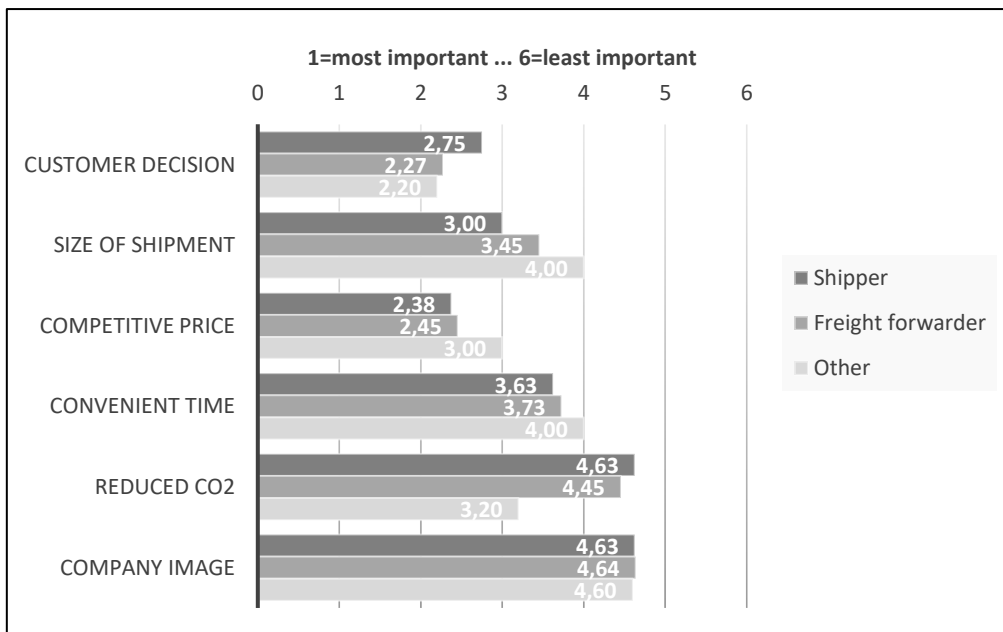


Figure 8. Importance of intermodal drivers by type of business
 (Source: Own compilation)

Figure 8 depicts priorities by business type. As expected, competitive pricing is the main concern of shippers. From the freight forwarders' perspective, however, customer preferences remain the decisive factor. An interesting observation is that the only occasion that environmental concerns climb above shipment size and transit time is when it comes to other businesses, probably pointing to the more distant positioning of this type of respondents to the realities of the market place.

5 Measures enhancing intermodal transport

This section is devoted to the part of the questionnaire dealing with the measures proposed for enhancing intermodal transport as assessed by our sample shippers. Before presenting these perceptions, however, the measures themselves are briefly described. The measures are grouped in five categories: capacity improvements; administrative/regulatory issues; information and communication infrastructure; market-based measures; and training in logistics.

5.1 Capacity improvements

There are three measures in this category, all of them relating to hard-core infrastructural improvements. They concern capacity improvements of existing links/nodes, the development of a dense network of logistics centres and the improvement of the road/rail access to ports and multimodal terminals.

5.1.1 Additional capacity of existing links/nodes

The latest TEN-T guidelines acknowledge the geographic fragmentation of the European transport network due to missing cross-border sections, disparities in the quality and availability of infrastructure especially between eastern and western parts of Europe, and missing connections with neighbouring countries (EP&C, 2013). The core network, consisting of the strategically most important parts of the network, was thus introduced, together with the core network corridors (CNCs), comprising its coordinated implementation tool. A European Coordinator was appointed to each of the nine CNCs to assist their completion by 2030.

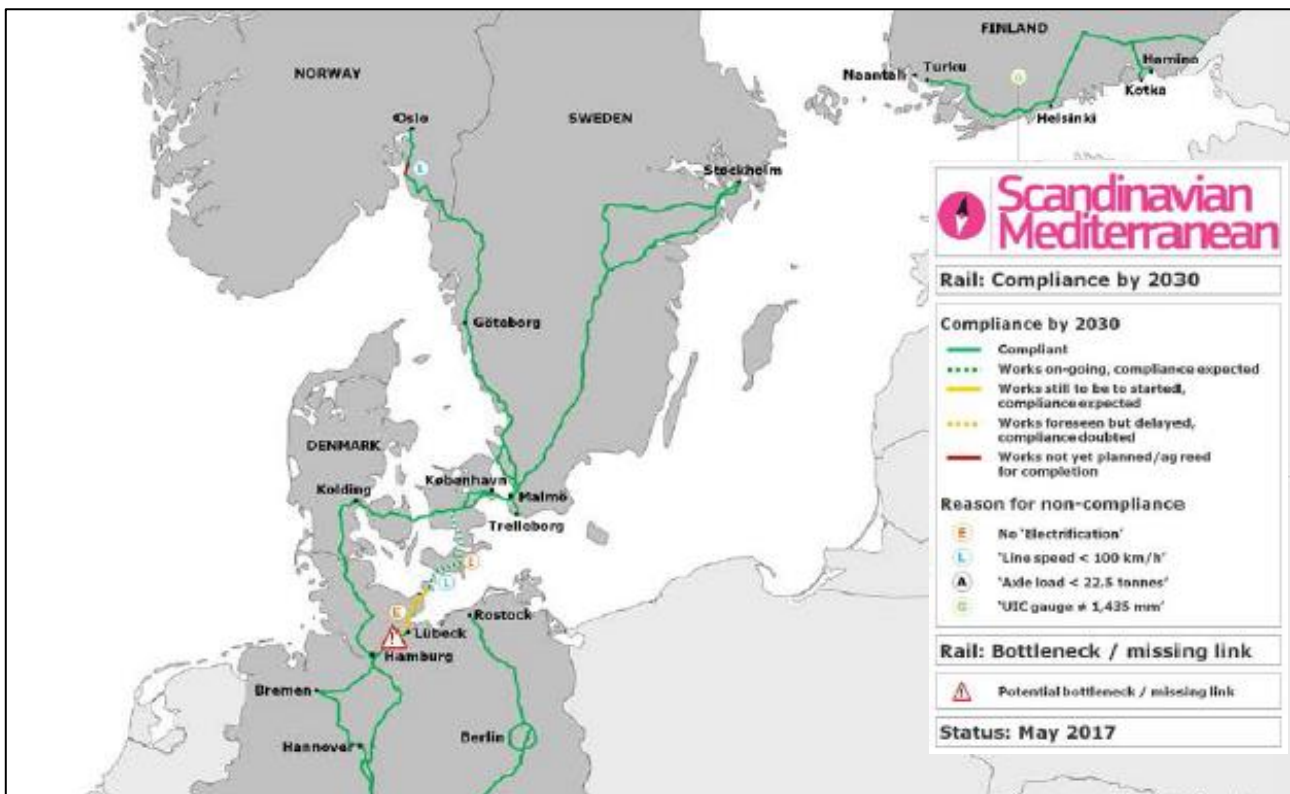


Figure 9. Expected compliance of the northern part of the ScanMed corridor railway infrastructure
(Source: Based on EC, 2018)

A set of minimum requirements is stipulated by the TEN-T guidelines for all types of infrastructure comprising the CNCs. Figure 9 shows the 2017 status and expected compliance by 2030 of the railway infrastructure of the Scandria® part of ScanMed, according to the 'Third Work Plan of the European Coordinator Pat Cox' (EC, 2018).

According to the same document, Pat Cox is concerned that, even after the construction of the planned infrastructure some bottlenecks will remain along the corridor, which might 'impede future growth of passenger and freight transport.' More specifically, these potential bottlenecks include:

- In Finland, for rail: Kouvola – HaminaKotka, Luumäki – Vainikkala, Helsinki, node, Helsinki – Turku; and for road: regions of Turku and Helsinki and the section Kotka–Hamina–Vaalimaa;
- In Sweden, for rail: Stockholm and Gothenburg node, Hässleholm – Lund, Trelleborg – Malmö (- Copenhagen);
- In Denmark, for rail: (Malmö-) Copenhagen region;
- In Germany, for rail: nodes Hamburg, Bremen and Kassel as well as the sections Hamburg – Ahrensburg (– Lübeck), Hamburg – Hannover/Bremen – Hannover; and for road: regions of Hamburg (motorway A1 and A7), Hannover/Kassel (A7), Berlin, Nuremberg (A3) and Munich (A9, A8).

5.1.2 Dense network of logistics centres

Multimodality calls for the modal integration of freight transport networks that requires a dense network of freight logistics centres in the form of freight villages and urban distribution centres.

EUROPLATFORMS, the European Logistics Platforms Association, defines freight villages as "... defined areas within which all activities relating to transport, logistics and the distribution of goods, both for national and international transit, are carried out by various operators" (www.europlatforms.eu/). A freight village must:

- be served by a multiplicity of transport modes (road, rail, deep sea, inland waterway, air),
- allow access to all companies involved in the activities set out above,
- be equipped with all the public facilities to carry out the above mentioned operations,
- include public services for the staff and equipment of the users, and
- be run by a single body, either public or private.



Figure 10. Panoramic view of the freight village in Nola, Italy
(Photo: Harilaos N. Psaraftis, 2011)

The advantages of a freight village such as that of Figure 10 that is located 23 km away from the port of Naples, Italy and to which is connected by a shuttle train are:

- concentration and optimisation of transport flows
- promotion of alternative to road transport modes
- increase of port capacity
- environmental and financial gains due to optimisation in terms of energy use and emissions
- promotion of business and operational collaborations.

Similarly, Urban Distribution Centres (UDCs) offer freight transport companies the opportunity to deliver goods destined for urban area to a specialist centre for final delivery rather than having to make the delivery to the final customer themselves in a busy part of the city. UDCs have the potential to improve delivery reliability and to improve the utilisation of goods vehicles. In addition, it is possible for a specialist fleet of environmentally-friendly goods vehicles to be used for the final delivery from the UDC to the customer. Given the environmental credentials of such vehicles in terms of pollutant emissions, noise and other factors, it can be possible to allow them to access and make deliveries in the urban area at times when delivery vehicles are usually prohibited, including during the night.

5.1.3 Better accesses to ports/terminals

The logistics centres of the previous section can serve multimodality only if adequately connected to multiple transport modes. These connections are also necessary for integrating the international trade flows that feed the European internal market. On the contrary, the lack of intermodal nodes, and therefore of efficient multimodal options, increases infrastructure capacity bottlenecks in all modes and particularly in road.

It is for these reasons that the TEN-T guidelines stipulate:

- “In the promotion of projects of common interest related to multimodal transport infrastructure ... priority shall be given to ... providing for effective interconnection and integration of the infrastructure of the comprehensive network, including through access infrastructure where necessary and through freight terminals and logistic platforms” (Article 29 - Priorities for multimodal transport infrastructure development)
- “When developing the comprehensive network in urban nodes, Member States shall, where feasible, aim to ensure ... for freight transport: interconnection between rail, road, and, as appropriate, inland waterway, air and maritime infrastructure of the comprehensive network” (Article 30 - Urban nodes)
- “Maritime ports of the core network ... shall be connected with the railway and road and, where possible, inland waterway transport infrastructure of the trans-European transport network by 31 December 2030, except where physical constraints prevent such connection” (Article 41 - Nodes of the core network).

In fact, the compliance of the ScanMed corridor to these requirements appears in Figure 11. In 2017, only 50% of the corridor ports were connected to inland waterways, while the connection to the railway network reached 83%. The electrification of the multimodal rail/road terminals was 35%, and only 14% of them could be accessed by trains longer than 740 m.

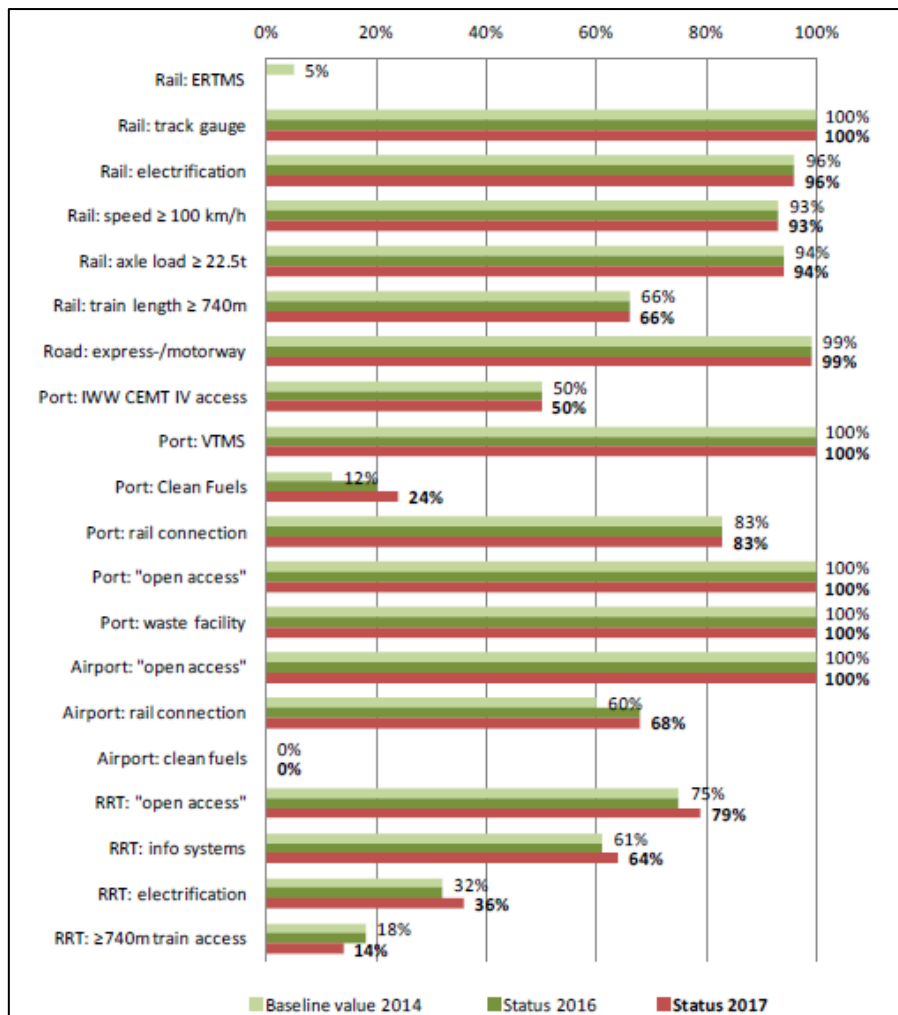


Figure 11. Development of selected KPIs, 2017 status against the 2014 baseline (Source: EC, 2018)

5.2 Addressing administrative/regulatory issues

This category of measures deals with administrative and regulatory barriers that obstruct the proper functioning of the logistics market and hinder the propagation of intermodal transport arrangements. Three measures are examined here that address the interoperability problems in the rail sector, the standardisation/dimensioning of logistics units and freight vehicles, and the simplification of administrative burdens in the shipping sector.

5.2.1 Interoperability improvements in the rail sector

Smooth and efficient rail operation in Europe is a desirable goal, which is hampered by the patchwork of different rail systems that exist. Differences range across a wide spectrum, including rail gauges (at least 4 different widths), electricity systems (at least 4 different systems), signalling systems (at least a

dozen different systems), various clearance profiles, various technical specifications of locomotives and other rolling stock, and many other differences, not the least of which is that trains in some countries run on the left and in some other countries on the right. Incompatibilities do exist even between systems that have similarities in many other respects. Such differences make the goal of rail interoperability very difficult to achieve unless specific, systematic and methodical action is taken.

The European Rail Traffic Management System (ERTMS) was developed to make rail transport safer and more competitive. It consists of two basic components:

- (i) ETCS, the European Train Control System, is an automatic train protection system that replaces the existing national systems and guarantees a common standard enabling trains to cross national borders while enhancing safety; and
- (ii) GSM-R, a radio system for providing voice and data communication between the track and the train, based on standard GSM using frequencies specifically reserved for rail application with certain specific and advanced functions.

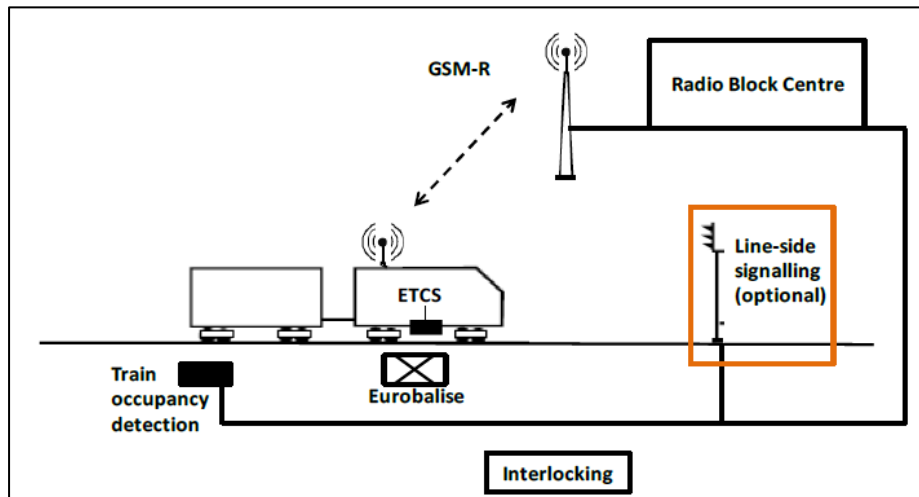


Figure 12. ETCS Level 3 configuration
(Source: Zacharioudakis et al., 2012)

When fully developed, ERTMS can:

- reduce transport time up to a maximum of 70%
- reduce headways between trains up to 110 seconds
- increase density of traffic (trains per hour) by 12%
- increase reliability to over 98%
- decrease freight insurance fees by up to 90%
- enable up to 40% more capacity on currently existing infrastructure, and
- enhance transportation modal shift towards rail.

5.2.2 Standardisation of logistics units and transport vehicles

The standardisation of modular logistics units in sizes suitable for multimodal flows of goods is a factor that could contribute in developing sustainable logistics in Europe and beyond. It would lead to significant reductions in costs and CO₂ emissions and would ultimately allow fully interconnected solutions across modes and transport networks.

Standardisation of pallets has resulted in European standard sizes and also in standard heights for specific product groups streamlining retail business practices with transport and warehousing

processes. Packaging recommendations for modules have also been developed by the European Standardisation Association. The Physical Internet, an open pooling arrangement of shared logistics networks and resources, also requires standardised modular boxes (Montreuil, 2011). If anonymous, equipped with the data carrier (RFID or bar codes) and easily traceable, the standardised logistics units (π -containers) could lead to increased load factors and better utilisation of assets. Moreover, a horizontal collaboration between shippers will become feasible and reversed logistics will be improved due to the reusability of the modular units.

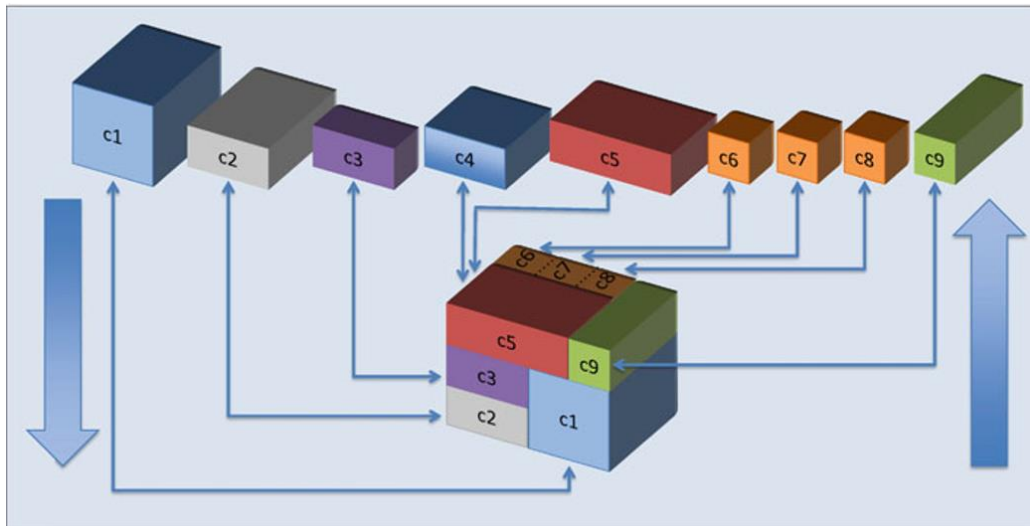


Figure 13. Illustrating the modularity of unitary and composite π -containers
(Source: Montreuil, 2011)

In relation to the dimensions and weights of road freight vehicles, Directive (EU) 2015/719:

- granted derogations from the maximum dimensions of vehicles for the addition of aerodynamic devices to the rear of vehicles and/or for redefining the geometry of the cabs for tractors,
- authorised a weight increase of one tonne for vehicles with an electric or hybrid propulsion, to take account of the weight of batteries or the dual motorisation, without prejudice to the load capacity of the vehicle,
- facilitated the development of intermodal transport by allowing a derogation of 15 cm in the length of trucks carrying 45-foot containers, which are increasingly used in intercontinental and European transport, and
- enabled the inspection authorities to better detect infringements through either weighing systems built into the road or by means of on-board sensors in vehicles, which communicate remotely with roadside inspectors.

However, the 25.25 m long modular combinations of Sweden and Finland are still of no universal use in Europe. **Longer trucks**, here denoting longer overall road-trains, are supported by many as they are associated with savings in cost and emissions, less congestion and less damaging to the road infrastructure than standard trucks since their weight is distributed over more axles. They are currently being tested in several countries such as Germany, the Netherlands and the UK.

In relation to railway transport, **longer trains** are already foreseen by the TEN-T guidelines, which require the core network corridor to accommodate 740 m long trains. Figure 11 shows that this condition is met by 66% of the ScanMed rail links, while a mere 14% of the rail/road terminals can serve that long trains.

5.2.3 Simplification of administrative burdens in the shipping sector

Complex administrative formalities lead to reduced competitiveness, meaning higher costs and lower service quality. Depending on the application, they can result in safety and security problems and/or adverse effects on the environment.

Maritime transport is the sector suffering the most from this type of inefficiencies. Vessels are subject to complex administrative procedures even when they sail only between EU ports (intra-EU maritime transport) and the cargo consists only of goods in free circulation ("Community goods"). Such procedures are not always properly coordinated, leading to delays, overlaps and excessive administrative costs.

Other administrative bottlenecks include the following:

- In some Member States certain customs documents have to be given in original to a customs office, which might be located far away from the quay, and opening times or the location of customs offices may cause logistical problems.
- In some ports, unloading of a ship can start only after all documentary formalities have been completed, which can take up to half a day.
- The transport of dangerous goods is restricted, costly and complicated at sea due to the overlap between bodies of technical legislation.
- Language difficulties are another bottleneck as some authorities in ports refuse ship manifests and certificates in languages other than their own.
- Pilotage services can be a serious problem. Vessels on SSS runs call regularly at the same ports, and their masters are familiar with the physical features. Nonetheless, in many cases pilot assistance is compulsory. While some countries do offer a Pilotage Exemption Certificate (PEC), there are often national requirements that make a PEC difficult to obtain.
- Electronic manifests are not universally accepted by all ports in the EU. Only 55% of ports use electronic systems for handling ship and cargo information, with the use of fax and telephone still common.
- Only a few Member States have a national single window approach. The linkage between the SafeSeaNet (SSN) and the port networks is very limited, and data exchange happens when the national authorities ask for it. The exchange of electronic messages between ports is practically non-existent.

In view of such problems, the Council of the European Union adopted at its 8 June 2017 meeting competitiveness and digitalisation as two of the three priorities for the EU's maritime transport policy until 2020, decarbonisation being the third one (Council, 2017).

5.3 Information and communication infrastructure

There are many ways, in which ICT applications support the logistics industry:

- Visibility and event management tools provide planners with the ability to respond to transport events as they occur
- Integration into point of sale systems provide planners with real time information enabling them to match supply and demand
- Sophisticated demand planning and inventory optimisation systems minimise inventory requirements increasing resource efficiency and reducing transport and storage requirements
- Sensor technologies provide planners with better real time information on location and state enabling pro-active planning and re-planning activities
- Integrated telematics systems enable real time monitoring of vehicle performance, location and positioning

- Transport management systems facilitate traffic flows on land, sea and in the air
- Transport network design tools optimise networks for flow and carbon emissions.

The measures examined here relate to stronger customer support, provision of information on available services, cargo tracking and tracing services, improved communication within the supply chain and cargo consolidation through on-line platforms.

5.3.1 Stronger customer support

In our era, customer plays a dominant role. The trend of increased individualisation in economic activity and consumption patterns affects both the structure and management of supply chains (through increased direct deliveries) and the intensity of demand in terms of frequency and size of shipments. This trend towards individualisation of economic activity cannot be seen in isolation from the rapid increase of electronic business (for both individuals and companies). The ongoing boost of e-commerce pushes the supply chains to their limits.

The improved performance of the supply chains can only be possible through the increased use of ICT applications often involving expert systems. They improve the knowledge base necessary for the provision of proactive, assisted and self-support services. They are offered 24 hours a day and 7 days a week anywhere in the world.

In addition, ICT applications are used for monitoring performance through indicators that encourage service quality. The performance of freight transport logistics chains, intermodal terminals, and urban transport logistics, and the systematic reporting of operational, infrastructure-related and administrative bottlenecks can all contribute in improving the quality of services offered.

5.3.2 Information on available services

Increased awareness of service availability is important not only for attracting more customers but also for improving the utilisation of the assets, with repercussions for the financial and environmental performance of the supply chains.

Article 28 of the TEN-T guidelines is explicit: “Member States shall ensure, in a fair and non-discriminatory way, that ... without prejudice to the applicable Union and national law, freight terminals and logistic platforms, inland and maritime ports and airports handling cargo are equipped for the provision of information flows within this infrastructure and between the transport modes along the logistic chain. Such systems are in particular to enable real-time information to be provided on available infrastructure capacity, traffic flows and positioning, tracking and tracing, and ensure safety and security throughout multimodal journeys.”

5.3.3 Cargo tracking & tracing services

These ICT applications are cellular- and satellite-based solutions providing information on the location and condition of the vehicle, the driver and the cargo (e.g. actual driven miles, fuel consumption, actual route information, load, revolving-driver behaviour, ignition, speed, green driving, idling fees and emissions fees). In addition to transparency, they have important financial and security implications. They use on-board telematics units to control, report, command or record events. Several applications of this type have been developed in the last decade for commercial vehicles. Good examples are the SmartBox, Veriwise, Agheera and Skymeter systems.

The Schenker Smartbox of Figure 9 is an innovative ICT system, which incorporates a GPS sensor suite mounted on the door of a container that tracks, monitors and detects changes in the cargo condition for 24 hours a day and 365 days a year worldwide. Applicable to all transport modes, it monitors parameters such as the:



Figure 14. The Schenker Smartbox real time tracking ICT
(Source: Zacharioudakis et al., 2012)

- geographical position (via Global Positioning System – GPS)
- temperature inside the container
- humidity inside the container
- light influx
- tilt level
- G-force impact
- door status (open - closed) and
- movement inside the container.

The collected data are transmitted via mobile communication networks (GSM) to the web portal of Schenker.

5.3.4 Communication within the supply chain

Current trends in logistics demonstrate a shift from competition among enterprises to competition among supply chains. The business environment is characterised by the requirement for supply chains to optimise their overall performance by removing barriers inhibiting the flow of materials/products, financial resources and information. In order to manage effectively the complex flows among supply chain partners and to improve efficiency and customer responsiveness, integration among the various supply chain partners is required.

Information sharing is considered as the basic pillar of supply chain integration. It has a positive effect on demand planning (including collaborative demand forecasting), capacity planning, planning of production activities, performance management, and inventory management and replenishment (among others). Information integration is considered as one of the most prominent future trends in supply chain management.

In addition to improving resource utilisation, information sharing is vital in applications related to international safety and security. The user communities need to access an ever increasing amount and variety of information, and move from a “need to know” to a “need to share” culture.

Information sharing is not free of challenges, though, as it requires:

- an approach interlinking all users
- technical framework providing interconnection of different information layers

- common standards
- no data duplication
- national, regional and international coordination
- protection of personal data and
- respect of commercially confidential information.

Telematics applications such as ITS for road transport, ERTMS for railways, RIS for inland waterways, VTMS and e-Maritime for maritime transport and SESAR for aviation all include components of this nature.

5.3.5 On-line platform for cargo consolidation

Until very recently, globalisation has been a powerful trend enabled by trade liberalisation agreements and technological advances that have reduced distances and time barriers. This has led to new ways of organising production and distribution, relying heavily on efficient supply chains. Industrial companies had a strong incentive to concentrate production in fewer factories (spatial concentration) through exploitation of economies of scale. Furthermore, through the wider sourcing of supplies, companies were able to take advantage of cost differences (e.g. raw materials cost, labour cost, manufacturing cost) among a larger number of regions/countries. This has led to an increase in the economic activity of the regions in which the cost of resources is lower. The relocation of production and wider sourcing and distribution, combined with the increased individualisation of consumption patterns, mentioned in Section 5.3.1, result in increased demand for freight transport services.

In view of mounting environmental pressures, the increased demand cannot be addressed simply by additional capacity. Collaborative logistics is a significant contributor to the efficient utilisation of assets as they offer a platform for clustering logistics activities and pooling resources. The TRI-VIZOR horizontal collaboration platform of Bogen and Verstrepen (2013) is a good example of cargo consolidation that improves the load factors of trucks, trains and ships.



Figure 15. Visualisation of a company's manufacturing and distribution locations across Europe
(Source: Bogen and Verstrepen, 2013)

The platform uses a Geographical Information System to visualise individual transport networks and validate collaborative opportunities. This visualisation (Figure 15) is useful for identifying missing and/or obsolete nodes and links in the network, thus facilitating the discussion with potential collaborators.

5.4 Introduction of market-based-measures

Market-based-measures have long been proposed for advancing the intermodal transport cause due to the importance that shippers ascribe to price, as manifested in Section 4. Financial incentives to intermodal solutions is the most direct form of such measures, while the internalisation of external costs of transport is a more ambitious, albeit more challenging, strategy towards this end.

5.4.1 Financial incentives to intermodal solutions

The best-known scheme of that sort in Europe is the Marco Polo programmes. With the aim of countering the rise in international road freight transport by shifting cargoes to railways, inland waterways and short sea shipping, or a combination of those transport modes, the EU legislator established in 2003 the first Marco Polo programme. It was meant to contribute to efficient and sustainable mobility by reducing the environmental side-effects of freight transport, easing road congestion and improving road safety (refer to Figure 16).

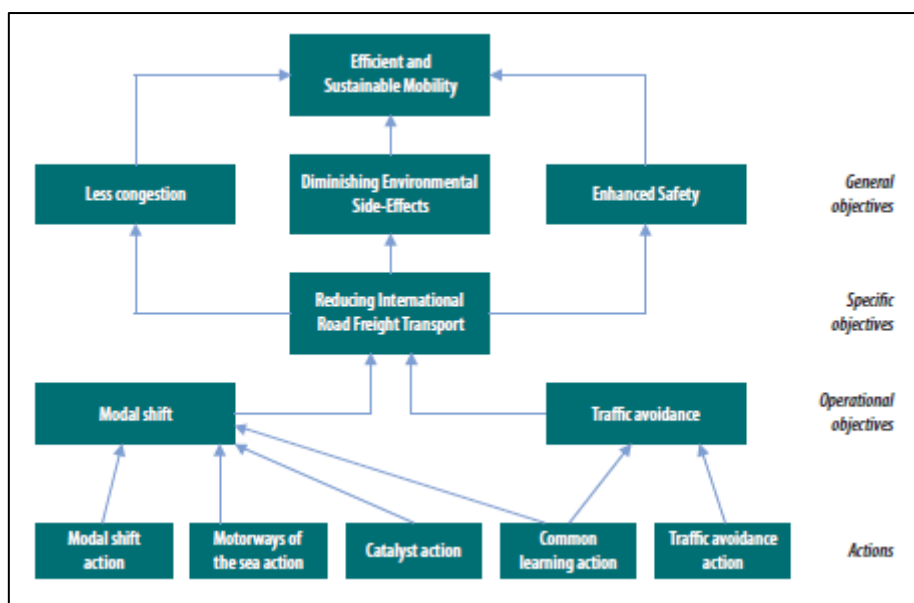


Figure 16. The Marco Polo programme overview and objectives
(Source: ECA, 2013)

The programme co-funded direct modal-shift or traffic avoidance projects, as well as projects providing supporting services that enabled freight to switch from road to other modes. Commercial undertakings, whether privately or publicly owned, could apply for funding provided that their project involved a cross-border route and made economic and ecological sense. Funding was in the form of an outright grant that provided support in the crucial start-up phase of a project before it paid its way to viability. Grants lasted from two to five years and projects should have been commercially viable by the time the funding stopped.

Marco Polo I (2003-2006) was followed by the larger Marco Polo II programme (2007-2014). Combined, the two programmes allegedly saved more than 4 million tonnes of CO₂ and shifted more than 4 million truckloads to rail, sea and inland waterway connections (<https://ec.europa.eu/transport/marcopolo/>).

In 2013, however, the EU Court of Auditors recommended the suspension of the programme on the grounds of “insufficient market uptake, absence of evidence of achieving the objectives, high administrative burden, poor sustainability and deadweight,” meaning that many of the audited projects would have started even without EU funding.

Another scheme supporting intermodal transport is the Eco-bonus system, a financial aid mechanism promoting short sea shipping. It was first applied in Italy as a temporary state aid scheme for freight operators moving from road to sea. This first implementation provided a subsidy of 20% of the seaway tariffs of existing services at the time, and up to 30% for new services. A certain minimum number of trips had to be performed by the benefited operator as a prerequisite for the subsidy. Due to limited resources and the ensuing recession, this scheme was operational only for a little bit over two years. More recently, there are new efforts attempting to implement similar schemes such as those in Norway and Sweden.

The Swedish scheme, amounting to a total investment of SEK 150 million, foresees a subsidy (SEK 0.12) to the ship operator for each tonne of goods shifted from road to sea. The ship operator can then select to pass this financial support to the cargo owner (shipper). Thus, the support becomes an aid to the shipper who can benefit from less costly sea freight. Among others, the requirements include:

- The initiative must relate to new or upgraded intermodal routes
- The initiative leads to a transfer from road to shipping
- The initiative must not be financially viable without support
- Economic viability must be reached no later than three years when the support ceases
- The aid may cover a maximum of 30 percent of the operating cost of the shipping route, or up to 10 percent of the cost of investment in transshipment equipment
- At least one Swedish port must be involved.

5.4.2 Internalisation of external costs of transport

Transport generates negative externalities that involve a cost to society and the economy. In addition to environmental impacts in terms of climate change, air pollution and noise, transport activities lead to costly congestion, accidents and the need to maintain the relevant infrastructure. Furthermore, transport activities contribute to the degradation of nature, landscape and sensitive areas, the pollution of soil and water, and they aggravate energy dependency (Maibach et al., 2008).

Internalisation of external cost of transport has been an important policy issue for many years in Europe and elsewhere in the world. From a welfare economics point of view, internalising external costs aims at efficiency gains through conveying the right price signal to economic actors. The right prices would encourage the use of safer, more silent and environmentally friendlier vehicles, as well as the planning of trips according to expected traffic. With the latest release of the White Paper on transport, the European Commission sets year 2020 as the deadline for the full and mandatory internalisation of external costs for all modes with emphasis on road and rail transport (EC, 2011).

In order to support its internalisation strategy, the European Commission commissioned a study – IMPACT – summarising the existing scientific and practitioner’s knowledge on the subject. The IMPACT study resulted in a handbook that contains a generally applicable, transparent and comprehensible model for the assessment of all transport related external costs by all modes (Maibach et al., 2008). Later on, this 2008 Handbook was updated to take into consideration the new developments in research and policy (Ricardo-AEA, 2014). Based on this information, Table 3 presents the marginal external costs associated with a 23.2 t rigid diesel truck, a 496 t diesel train and a 659 t electric train, all expressed in

2015 € per vehicle-kilometre. In addition to the range of variation, the table provides a ‘medium’ estimate that corresponds to the average estimate resulting from a number of studies analysed by the handbook. The last line of Table 3 transforms these estimates into unit costs, expressed in € per tonne-kilometre. In accordance with the EcoTransIT World model (<https://www.ecotransit.org/basis.en.html>), an average utilisation rate of 50% has been assumed for road and 40% for railway transport.

Table 3. Illustrative EU marginal external costs of representative road and rail vehicles (€/vkm)

External cost	Diesel truck (23.2 t)			Diesel train (496 t)			Electric train (659 t)		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
Climate change	0.0360	0.0859	0.2428	0.8266	1.5499	2.8931	0.0000	0.0000	0.0000
Air Pollution	0.0013	0.0899	0.4850	0.1232	3.9575	6.4143	0.1570	0.5344	0.9232
Noise	0.0005	0.1026	0.6042	0.0166	0.6139	3.3358	0.0166	0.6139	3.3358
Accidents	0.0025	0.0152	0.0380	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Congestion	0.0000	0.5138	7.7744	0.0397	0.0397	0.0397	0.0527	0.0527	0.0527
Infrastructure	0.0190	0.0659	0.5711	0.2000	0.3700	0.7000	0.2000	0.3700	0.7000
Total cost (€/vkm)	0.0593	0.8732	9.7155	1.2064	6.5313	13.3832	0.4266	1.5713	5.0120
Unit cost (€/tkm)	0.0051	0.0753	0.8375	0.0061	0.0329	0.0675	0.0016	0.0060	0.0190

(Source: Own compilation based on Ricardo-AEA, 2014)

Despite the wide range of fluctuation and the numerous assumptions behind these estimations, it is clear that trucks generate higher external costs than trains, especially when the latter are electrified. In this sense, an internalisation of the external costs across all modes would favour intermodal arrangements against only-road hauls.

5.5 Training in logistics

In many areas of freight transport logistics there are shortages of skilled personnel. It is, therefore, necessary to enhance the attractiveness of logistics professions and to encourage mobility of staff across borders. The ageing of the European population is aggravating this problem, which was already identified in the 2007 Freight Logistics Action Plan of the European Commission (EC, 2007). Targeting interventions towards training in logistics was, thus, proposed by the Action Plan as a means to alleviate these labour shortages.

In view of the differences in the training that European universities and other institutions provide, the Action Plan stressed the need of standardising both training activities and the qualifications of logistics personnel. A voluntary, mutually recognisable certificate for freight transport logistics and related areas (e.g. warehousing) could support lifelong learning and facilitate mobility.

During the 12 years that elapsed since the Action Plan, the advent of digital technologies has generated new needs. No sector will be left intact, as digitalisation is expected to have far-reaching impacts on productivity, income distribution, well-being and the environment. In the logistics field, the widespread digitalisation along with rapid developments in automation, robotics and artificial intelligence transform the entire supply chain together with the corresponding business models.

The so-called T-shaped competence profile for all newly trained logisticians was already introduced in the beginning of this decade. In this profile, while the vertical bar on the T represents the depth of related skills in a single field, the horizontal bar is the ability to collaborate across disciplines with experts in other areas and to apply knowledge in areas of expertise other than one's own. Digitalisation puts more

emphasis on the horizontal part of the profile, calling for communication, collaboration and entrepreneurial skills in addition to the traditional logistics related ones.

It is widely accepted that digitalisation will further redefine the role of labour in pervasive ways and with disruptive effects. If these predictions prove correct, then a large portion of the workforce will need to be retrained. In the field of logistics, the retraining needs go beyond the workers who will lose their jobs due to technological development ('technological unemployment'). For several years in the future, autonomous vehicles of all types will share the same infrastructure with conventional ones. This creates the need to retrain existing personnel for their encounter with autonomous vehicles/vessels.

5.6 Shipper priorities

All respondents of the sample, irrespective of having an intermodal experience or not, were asked to rate the intermodality supporting measures described above in a 5-point scale of importance. The results are shown in Figure 17 in a decreasing importance order.

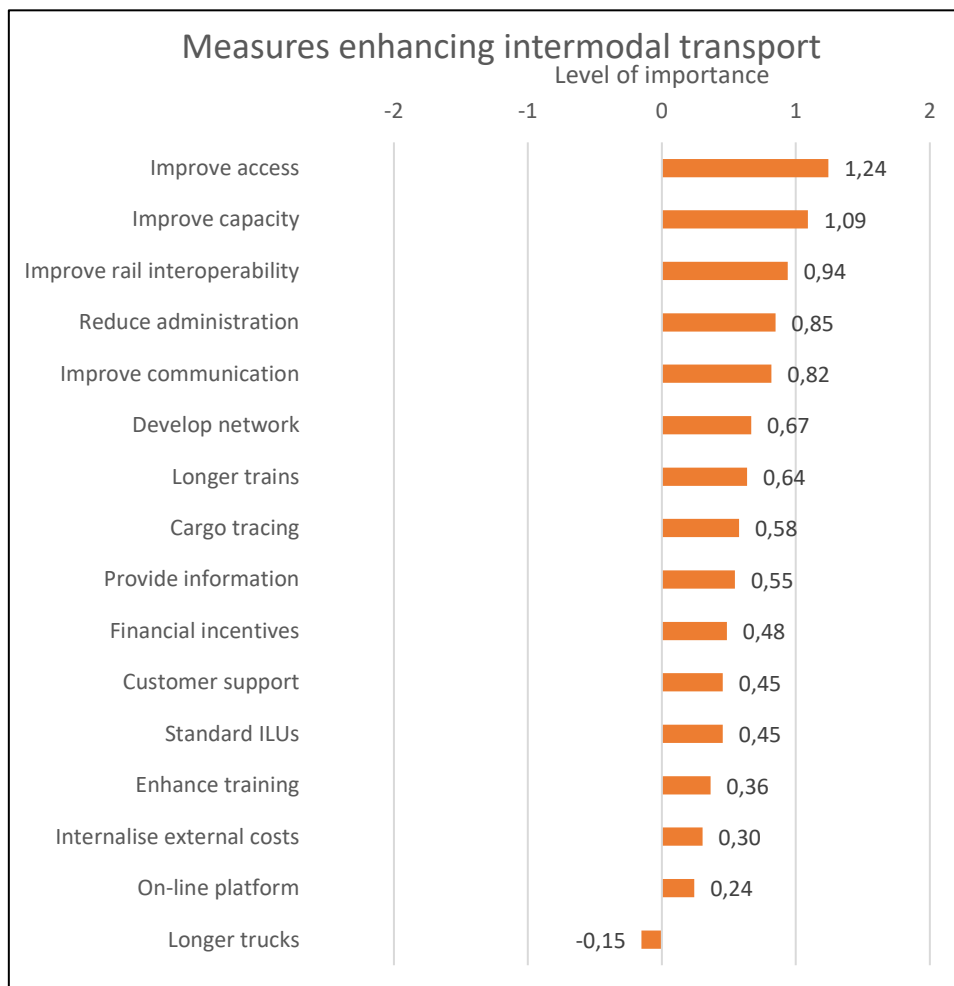


Figure 17. Average importance of measures supporting intermodal transport
(Source: Own compilation)

All of the measures score above average on the importance scale with the exception of longer trucks, a fact that probably demonstrates a tilt towards rail transport in the sample. It is worth noting that infrastructural aspects enjoy the top two positions, namely the improvement of road and rail accesses to multimodal terminals/ports and the strengthening of the capacity of existing facilities/links. The second most important group of measures targets barriers related to the harmonisation/administration of railways (interoperability problems) and waterborne transport (administrative and regulatory issues). Improved communication aiming at information exchange between all actors in the supply chain (e-freight, e-maritime, etc.) attracts the highest attention among the ICT-related measures of Section 5.3. Among the market-based measures, the provision of financial incentives to the users of intermodal arrangements is more popular than internalising external costs of transport. Neither the enhancement of training in logistics is very high in the priority list.

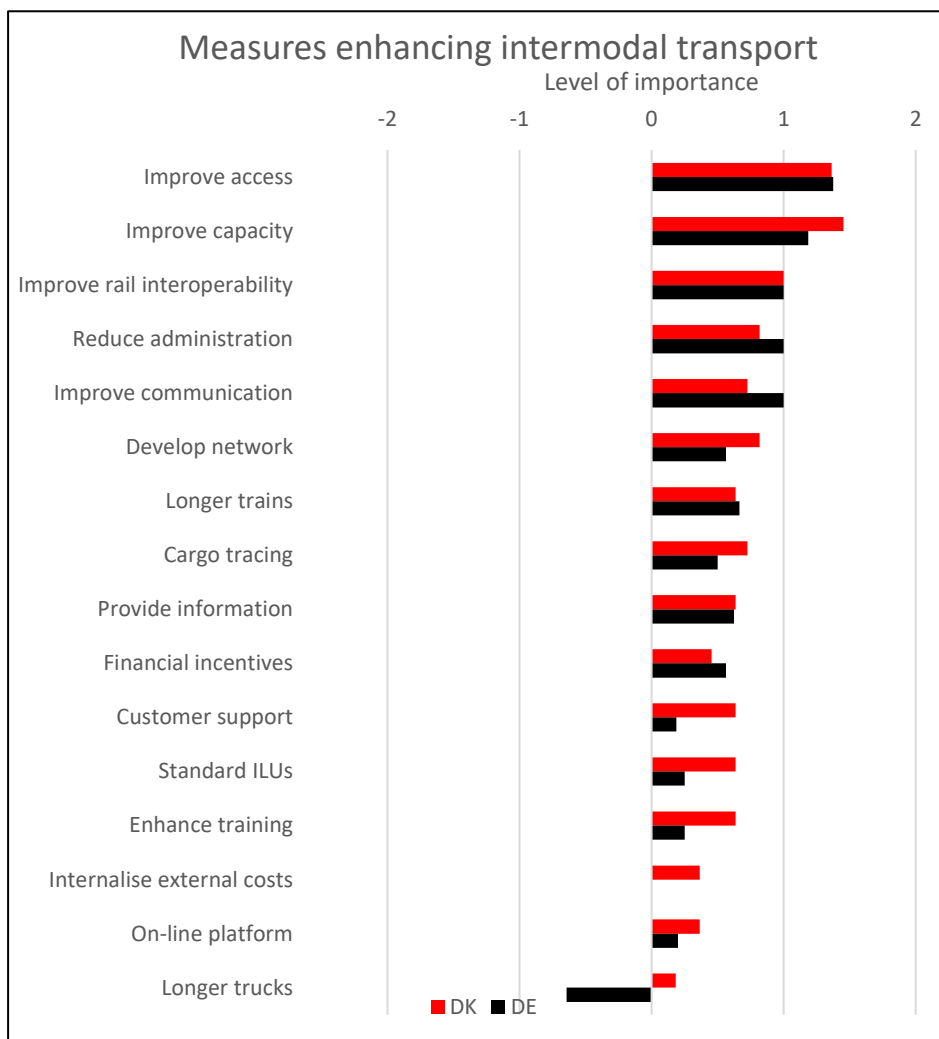


Figure 18. Importance of measures supporting intermodal transport by country of registration
 (Source: Own compilation)

The rating of the measures by country of registration appears in Figure 18. The basic trends identified above still hold true for both Germany and Denmark. The main difference relates to longer trucks, where a negative assessment in Germany (-0.64) contradicts the weakly positive rating of Denmark (0.18).

The promotion of the survey through the Logistics Initiative Hamburg network that is more rail-oriented might have played a role in this regard. Other than that, the Danish side seems to have a stronger interest in infrastructural issues such as the improved capacity of existing facilities and the development of the logistics centre network, while Germans place more attention on problems caused by administrative/regulatory issues and the lack of communication within the supply chain. Furthermore, the Danish assessment is a bit more balanced with 9 different measures scoring between 0.64 and 0.82.

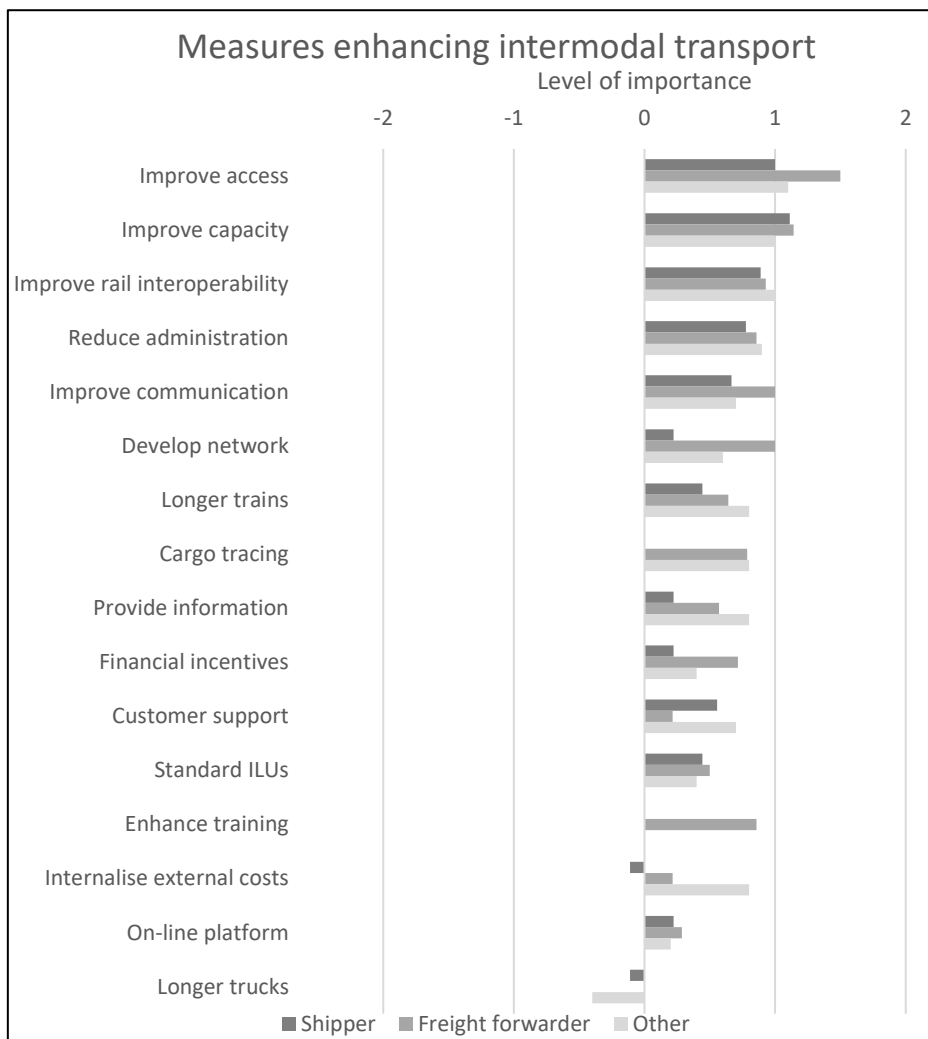


Figure 19. Importance of measures supporting intermodal transport by type of business
 (Source: Own compilation)

Figure 19 displays significant differences in the preferences of the users. Freight forwarders are much more sensitive than shippers in issues such as improved accesses to ports and terminals, higher density of the logistics centre network, adequate cargo tracking and tracing services, enhanced training in logistics, improved communication within the supply chain and the provision of financial incentives for intermodal solutions. Shippers, on the other hand, wish better customer support and are not very keen in internalising external costs, which seems to be a major concern for the group of other businesses. This latter group joins shippers in their request for better customer support, asks for more information on available intermodal services and strongly opposes longer trucks.

5.7 Other concerns

When setting the goal of shifting 30% of road freight over 300 km to other modes such as rail or waterborne transport by 2030 (and more than 50% by 2050), the 2011 White Paper (EC, 2011) makes the implicit assumption that the distance of 300 km is the minimum required to make intermodal transport a feasible alternative to road haulage. The respondents to our questionnaire were asked for their opinion on this subject. The results obtained are shown in Figure 20. The 300 km estimate seems to be the most popular view. Three respondents suggested a shorter distance (175 km on average). About one fourth of the sample, however, consider the 300 km mark as too short. The distances proposed range from 400 to 1000 km, the mean value being 587.5 km. This happens to be very close to the 600-700 km estimate that Janic (2008) proposed as the break-even distance between a long intermodal freight train and a truck.

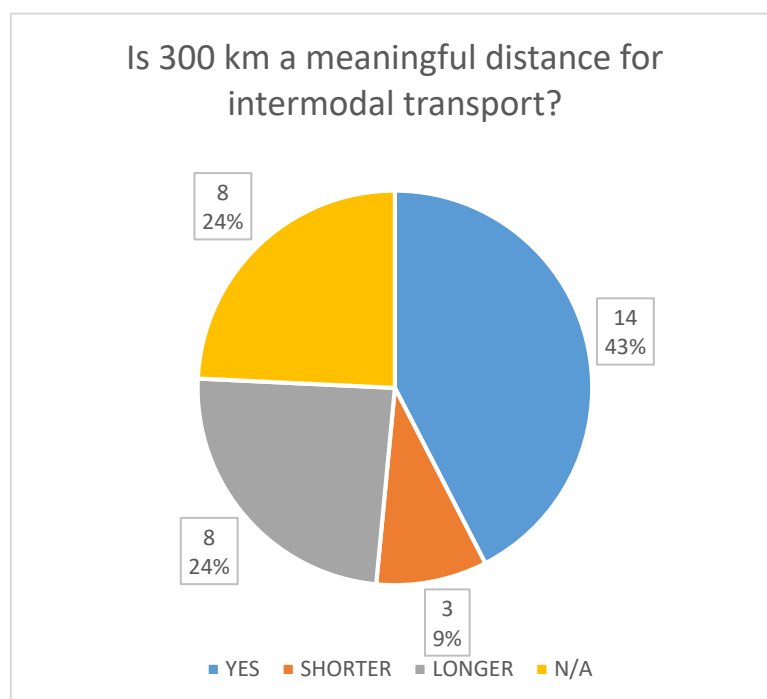


Figure 20. Minimum distance requirements for a competitive intermodal arrangement
(Source: Own compilation)

On a different subject, the respondents were asked to identify trends that have influenced their freight logistics behaviour during the last decade. Among the feedback received, the following comments are of particular interest:

- Trucking rates have been dropped because of overcapacity in the EU and the arrival of Eastern European truckers
- In combination with smaller shipments, these lower prices make intermodal transport even more challenging
- There is a lack of skilled labour in all transport sectors
- Bigger shippers with significant purchasing power have entered the market
- Customers pay less attention to quality and are less loyal to their suppliers

- The logistics industry becomes more sophisticated and warehouse management becomes more and more important
- Inland terminals suffer from storage capacity limitations, while the processing times at terminals (both seaport and inland) have been prolonged.

In relation to influential future trends, the comments received include the following:

- The propagation of e-commerce will reduce the number of full-truck loads and increase the speed and visibility of last-mile deliveries
- The environmental aspects will gain importance
- Digitalisation (including 3D-printing, blockchain, etc.) and automation will reshape the provision of logistics services
- Enhanced ITS applications may generate more road traffic and increase environmental impact
- The continuing problems with labour supply (truck drivers) and the capacity limitations of the road network will lead to increased intermodality favouring both the railway and shortsea solutions.

When asked about more localised issues of interest, the respondents called attention to:

- The need to modernise German ports
- The effects of a possible Brexit.

On any other related issue, respondents noted that:

- Freight forwarding is not attractive to young professionals, and the logistics industry should do something about it
- Logistics do not come free. The users should be prepared to bear the relevant cost.

6 Conclusions

In supporting multimodal freight transport services, Activity 3.2-3 focuses on identifying the priorities of the shippers (cargo owners) in relation to intermodal logistics solutions that comprise the core of multimodality.

A literature search was performed on this subject. It identified a long list of characteristics that shippers consider necessary for efficient and effective intermodal transport. They include price, delivery time, time reliability of delivery, frequency of shipments, cargo safety and security, reliability of pick up time, ability to respond to customer needs, proactive notification of problems, etc. A number of pre-conditions were also identified. They include the commodity type, value, density and time-sensitivity, freight distance, direction of haul (head-haul/back-haul), meaningful load factors and transshipment costs.

Two of the reviewed studies are of more value to the specific geographic context. The first, produced in 2011 by the Scandria® project, identified the main problems hindering intermodal transport. They can be summarised as follows:

- Transport time in intermodal transport is usually longer than in classic road transport
- Intermodal transport is less reliable if a national border needs to be crossed
- Intermodal transport requires large load volumes to make a train economically feasible
- Transport distances usually need to be longer than 300 km to make intermodal transport feasible
- Lack of knowledge and experience in intermodal transport on the forwarder side
- Lack of knowledge about schemes offering financial support
- Lack of a cooperation partner in the recipient region
- Lower flexibility in terms of frequency of service and shipment size.

The second and more recent study was published in 2018 by the NSB CoRe project. Through a series of interviews with companies from the private sector of six countries (Finland, Estonia, Latvia, Lithuania, Poland and Germany), the study identified the most important barriers and advantages of intermodality. Price was found to be the most important barrier for both shippers and logistics service providers, followed by transit time. Other barriers examined include the provision of information, the network of logistics centres, safety and the availability of resources. Price and transit time/reliability were also the top advantages of intermodal solutions. Image aspects, safety/security and customer requirements were also examined as positive elements of intermodal transport.

Based on the results of the literature search, a questionnaire was designed for obtaining shippers' assessment of their experience with intermodality, the factors driving it and the measures proposed for its promotion. It is noted that the latter subject has not been treated by the previous studies examined. After being revised on the basis of feedback received from logistics experts, the questionnaire was promoted through shipper associations in the five study countries (Germany, Denmark, Sweden, Norway and Finland). Responses were received through an electronic survey lasted from July 2017 to June 2018. The questionnaire was also distributed in paper form to the participants of the event "Future transport and logistics in the Fehmarnbelt Region – How to be prepared for changing cargo flows" on 29 May 2018 during the Fehmarnbelt days 2018 in Malmö, Sweden. Furthermore, responses were enriched by a number of interviews from selected companies and associations.

The majority of the 33 usable responses obtained comes from Germany and Denmark. The companies that have arranged intermodal shipments during 2016 find their experience more than satisfactory. Germans appear to be 25% happier with intermodality than their Danish counterparts, who are still satisfied. The differential is greater with regard to business types. Freight forwarders, who are more exposed to intermodal realities than shippers, display a much higher satisfaction than the latter, who fall a bit short of the satisfactory level albeit still on the positive side.

Among the reasons for going intermodal, the specific customer/supplier instructions appear to be the most important one. This finding suggests the need to identify the right decision-makers prior to designing activities promoting intermodal transportation. Competitive pricing follows suit surpassing all other quality characteristics (in Germany, it is even more important than customer preferences). This result contradicts the findings of other studies that assign more importance to attributes such as frequency of service, reliability, etc. The appropriateness of shipment size and the convenience of transit time follow price concerns in the scale of importance. It is interesting to note that the advantages offered by intermodality in terms of low emissions and improved company image appear very low in the importance spectrum despite the emphasis placed on them by the policy makers.

As expected, the type of business has a bearing on these priorities. Competitive pricing is the main concern of shippers, while from the freight forwarders' perspective, customer preferences remain the decisive factor. An interesting observation is that the only occasion that environmental concerns climb higher than shipment size and transit time is when it comes to other businesses, probably pointing to the more distant positioning of this type of respondents to the realities of the market place.

The literature search also led to a list of 16 measures that have been proposed for the advancement of intermodal transport. They are briefly presented in five groups:

- Capacity improvements (additional capacity of existing links/nodes; dense network of logistics centres; and better accesses to ports/terminals)
- Administrative/regulatory issues (interoperability improvements in the rail sector; standardisation of logistics units and transport vehicles including longer trucks and trains; and simplification of administrative burdens in the shipping sector)
- Information and communication infrastructure (stronger customer support; information on available services; cargo tracking and tracing services; communication within the supply chain; and on-line platform for cargo consolidation)
- Market-based measures (financial incentives to intermodal solutions; and internalisation of external costs of transport)
- Training in logistics.

All these measures received a positive response (above average importance) from the respondents with the exception of longer trucks (although weakly supported in Denmark). Infrastructural aspects enjoy the top two positions, namely the improvement of road and rail accesses to multimodal terminals/ports and the strengthening of the capacity of existing facilities/links. Addressing the interoperability problems of rail transport and the administrative/regulatory burdens of (mainly waterborne) transport are also given a lot of attention. Improved communication aiming at information exchange between all actors in the supply chain (e-freight, e-maritime, etc.) attracts the highest attention among the ICT-related measures, while in the market-based group, the provision of financial incentives to the users of intermodal arrangements is more popular than internalising external costs of transport. Neither the enhancement of training in logistics is very high in the priority list.

Freight forwarders are much more sensitive than shippers in issues such as improved accesses to ports and terminals, higher density of the logistics centres network, adequate cargo tracking and tracing services, enhanced training in logistics, improved communication within the supply chain and the provision of financial incentives for intermodal solutions. Shippers, on the other hand, wish better customer support and are not very keen in internalising external costs, which seems to be a major concern for the group of other businesses.

In relation to the minimum distance requirement for a competitive intermodal arrangement, almost half of the sample accepts the 300 km mark used by the European Commission in their goal associated with intermodal transport (shifting 30% of road freight over 300 km to other modes such as rail or waterborne transport by 2030, and more than 50% by 2050). One fourth of the respondents, however, feel that this estimate is too short, proposing distances from 400 to 1000 km.

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Annexes

A1. Glossary

Combined transport

The transport of goods between origin and destination where the lorry, trailer, semi-trailer, with or without tractor unit, swap body or container of 20 feet or more uses the road on the initial or final leg of the journey and, on the other leg, rail or inland waterway or maritime services where this section exceeds 100 km as the crow flies (Based on the definition provided by the International Union of Railways – UIC, 2016).

Freight forwarder

A person or company that organises shipments for individuals or corporations to get goods from the manufacturer or producer to a market, customer or final point of distribution (Random House Unabridged Dictionary, 1997).

Intermodal transport

The movement of goods in one and the same loading unit or vehicle, which uses at least two different modes in a door-to-door transport chain without handling of the goods themselves in changing modes (Based on the definition used by the European Conference of Ministers of Transport).

Shipment (also called consignment)

Cargo transported under the terms of a single bill of lading or air waybill, irrespective of the quantity or number of containers, packages, or pieces (BusinessDictionary).

Shipper

Consignor, exporter, or seller (who may be the same or different parties) named in the shipping documents as the party responsible for initiating a shipment, and who may also bear the freight cost (BusinessDictionary). The shipper, also referred to as cargo owner, may be a manufacturer or a trading company.

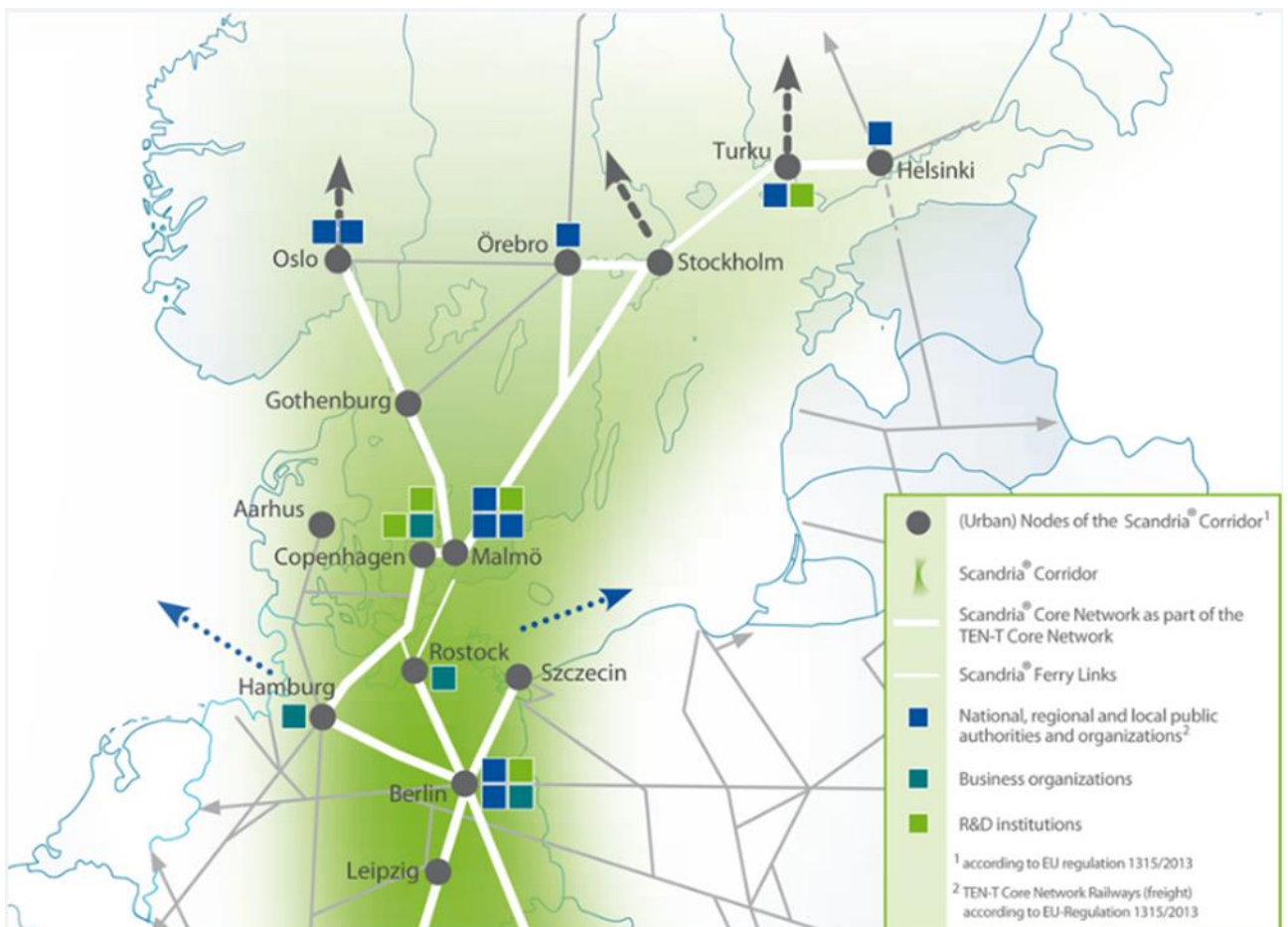
A2. The questionnaire

Copenhagen, 20 March 2018

Dear Sir/Madame,

Subject: SHIPPER NEEDS SURVEY / Scandria® Corridor

We kindly ask you to fill out this questionnaire. The survey addresses the requirements that shippers and freight forwarders impose on arranging intermodal shipments along the Scandria® corridor. It aims at identifying issues and trends influencing freight logistics in the Scandria® area, which appears in the figure below together with the respective part of the TEN-T Core Network. The results will support all actors involved in the development and implementation of intermodal transport solutions in the region.



The survey is organised by the Technical University of Denmark (DTU), a partner of the Scandria[®]2Act project. Co-funded by the Interreg Baltic Sea Region programme, Scandria[®]2Act aims at the harmonised development of the regions located along the Scandria[®] corridor. It is a continuation of the older Scandria[®] project that focuses on regional development challenges associated with transport. Its main objective is to increase the connectivity and competitiveness of corridor regions while minimising the negative environmental impacts of transport. For this purpose, it contains actions concerning:

- the development of clean fuels,
- the development of multimodal transport services, and
- the establishment of a multilevel governance mechanism, the Scandria[®]Alliance.

The present survey comprises one of the activities supporting the development of multimodal transport services. Intermodal transport (the use of standardised load units, such as standard shipping containers, swap-bodies or trailers) supports multimodal transport by exploiting the advantages of all transport modes. For the sake of completeness, we provide definitions of the basic terms used in each question. If you are familiar with these terms, please feel free to skip the definitions. More information about the project and its components can be found in the following link:

<http://www.scandria-corridor.eu/index.php/en/projects/scandria2-act>.

The questionnaire consists of both structured and open questions. **It will take less than 10 minutes to fill out.** The survey is simultaneously circulated in Germany, Denmark, Sweden, Norway and Finland.

For confidentiality purposes, no personal information is requested by the questionnaire. As such, we have no way of contacting you for clarifications or further discussion. If you would like to discuss a related issue with us or include the views of you or your affiliation in our survey report, please contact us directly at the addresses shown below.

Your expertise is valuable to our work. We thank you in advance for your kind cooperation and support in shaping better freight systems in Europe.

On behalf of the Scandria[®]2Act project

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1. General information on the respondent

1.1 Type of business

Please indicate your selection by placing an “X” in front of the appropriate option.

- Shipper⁽¹⁾
- Freight forwarder⁽²⁾
- Other, please specify:

- (1) Shipper: Consignor, exporter, or seller (who may be the same or different parties) named in the shipping documents as the party responsible for initiating a shipment, and who may also bear the freight cost (BusinessDictionary). The shipper, also referred to as cargo owner, may be a manufacturer or a trading company.
- (2) Freight forwarder: A person or company that organises shipments for individuals or corporations to get goods from the manufacturer or producer to a market, customer or final point of distribution (Random House Unabridged Dictionary, 1997).

1.2 Country of registration

Please select one from the drop down options.

1.3 Number of employees

Please indicate your selection by placing an “X” in front of the appropriate option.

- up to 10
- 11 – 50
- 51 – 250
- over 250

1.4 Position within your affiliation

Please indicate your selection by placing an “X” in front of the appropriate option.

- General manager
- Operations manager
- Sales/purchases
- Logistics
- Other, please specify:

1.5 Did your company arrange at least one intermodal shipment to a location more than 300 km away during 2016?^(3, 4)

Please indicate your selection by placing an "X" in front of the appropriate option.

- Yes → **Please proceed with Question 2.1.**
- No → **Please proceed with Question 3.1.**

- (3) Intermodal transport: The movement of goods in one and the same loading unit or vehicle, which uses at least two different modes in a door-to-door transport chain without handling of the goods themselves in changing modes (Based on the definition used by the European Conference of Ministers of Transport).
- (4) Shipment (also called consignment): Cargo transported under the terms of a single bill of lading or air waybill, irrespective of the quantity or number of containers, packages, or pieces (BusinessDictionary).

2. Questions to companies with intermodal transport activity during 2016

2.1 Please rank the following reasons for selecting an intermodal solution in order of decreasing importance

Please assign "1" to the most important item and "6" to the least important one.

- Specific instructions from customer/supplier
- Size of shipment
- Competitive price
- Convenient door-to-door transit time
- Reduced CO₂ (and other greenhouse gas) emissions
- Improved company image
- Other, please specify:

2.2 General degree of satisfaction with the intermodal transport solutions you have tried

Please indicate your selection by placing an "X" in front of the appropriate option.

- Very satisfied
- Satisfied
- Indifferent
- Disappointed
- Very disappointed

Please proceed with Question 4.1.

3. Questions to companies with no intermodal transport activity during 2016

3.1 Have you ever used or considered using an intermodal transport arrangement?

Please indicate your selection by placing an “X” in front of the appropriate option and sub-option if applicable. In case you have rejected/discontinued an intermodal arrangement for a combination of reasons, please select the most decisive one among them.

No, never **Please proceed with Question 4.1.**

Yes, we have arranged intermodal shipments in the past but the conditions have changed since then **Please proceed with Question 4.1.**

Yes, we have arranged intermodal shipments in the past but the experience has been unsatisfactory for:

physical/technical reasons **Please proceed with Question 3.2.**

financial/quality-related reasons **Please proceed with Question 3.3.**

organisational reasons **Please proceed with Question 3.4.**

Yes, we have considered this alternative but it was rejected for:

physical/technical reasons **Please proceed with Question 3.2.**

financial/quality-related reasons **Please proceed with Question 3.3.**

organisational reasons **Please proceed with Question 3.4.**

Other, please specify:

Please proceed with Question 4.1.

3.2 Please rank the following physical/technical reasons for rejecting/discontinuing intermodal transport arrangements in order of decreasing importance

Please assign “1” to the most important item and “6” to the least important one.

Cargoes unsuitable for intermodal solutions

Short transport distances

Inadequate network/vehicle capacity

Interoperability problems in the rail sector (in terms of technical incompatibility)

Small consignments (less than full container loads)

Scarcity of logistics centres in the region

Other, please specify:

Please proceed with Question 4.1.

3.3 Please rank the following financial/quality-related reasons for rejecting/discontinuing intermodal transport arrangements in order of decreasing importance

Please assign "1" to the most important item and "6" to the least important one.

- Too expensive in comparison to road transport
- Long door-to-door transit times
- Inadequate reliability (in terms of timely delivery)
- Low frequency of service
- Lack of flexibility in terms of cargo pick-up/delivery time
- High safety/security risks
- Other, please specify:

Please proceed with Question 4.1.

3.4 Please rank the following organisational reasons for rejecting/discontinuing intermodal transport arrangements in order of decreasing importance

Please assign "1" to the most important item and "9" to the least important one.

- External decision making (by customers/suppliers)
- Lack of appropriate services
- Inadequate information about intermodal services
- Inadequate customer support
- Inadequate tracking & tracing services
- Too complicated to arrange (including empty repositioning)
- Lack of appropriate skills
- High administrative/bureaucratic burden
- Inadequate information exchange between operators/terminals
- Other, please specify:

Please proceed with Question 4.1.

4. Questions to all companies

4.1 How would you rate the importance of the following actions in enhancing the development of intermodal transport?

Please indicate your opinion by placing an "X" in the appropriate box next to each action.

Action	Very important	Important	Of average importance	Of low importance	Not important	Not applicable
Develop the network of logistics centres						
Improve capacity of existing facilities/links						
Improve the road and rail accesses to ports/terminals						
Address the interoperability problems of rail transport						
Allow longer trains						
Allow longer trucks						
Standardise modular logistics units (e.g. 45' pallet-wide containers)						
Provide easy access to information on available intermodal services						
Provide adequate cargo tracking & tracing services						
Enhance customer support (incl. order management)						
Provide an on-line platform for cargo consolidation						
Improve information exchange between all actors (e-freight, e-maritime, etc.)						
Reduce other administrative & regulatory burdens						
Enhance training in logistics						
Internalise external costs of transport						
Provide financial incentives to the users of intermodal arrangements						
Other, please specify						

4.2 Do you agree that the minimum distance that makes intermodal transport meaningful is 300 km?

Please indicate your selection by placing an "X" in front of the appropriate option.

- Yes
- No, it should be shorter. Please provide an indicative figure: ____ km.
- No, it should be longer. Please provide an indicative figure: ____ km.
- Don't know.

4.3 Please identify universal trends/drivers that have influenced your freight logistics behaviour during the last decade

Please type in your answer.

4.4 Please identify universal trends/drivers that are expected to influence your freight logistics behaviour in the future

Please type in your answer.

4.5 Please identify local, national or macro-regional issues that are expected to influence your freight logistics behaviour in the future

Please type in your answer.

4.6 Please provide any other comment you would like to make on the issues dealt with in this survey

Please type in your answer.

**Thank you for your time and effort.
Your input is of great value to us.**