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FOREWORD

Ports that operate as gateways have always been sensitive to changes in socio-economic trends. Ports enable the carriage of goods by sea, thus they are subject changes triggered by many factors: changes in the socio-economic structures of the regions they serve, changes in legislation, changes due to environmental issues and so on. Adapting to changes requires a proactive and collaborative attitude from the whole port community. Ports need to be aware of the factors that cause change but they can also affect their own future by creating demand, establishing new relations and by attracting shipowners. Fostering collaboration is just as important, since many issues affecting the daily activities carried out at ports are beyond the control of the port authorities.

This report was written as part of the PENTATHLON (PENTA) project. The PENTA ports are those of Stockholm, Helsinki, Tallinn, Turku and Naantali. The project explored alternatives and developed measures to better comprehend and face current and future challenges concerning maritime transport, while also increasing the competitiveness of the ports. Three research institutes in three Central Baltic countries – the University of Turku, Centre for Maritime Studies in Finland; the Estonian Maritime Academy in Estonia; and the Transport Research Institute (TFK) in Sweden – collaborated together and with the Ports of Stockholm, Helsinki, Tallinn, Turku and Naantali in the implementation of the project. The PENTA project was financed by the Central Baltic INTERREG IV A Programme 2007-2013 of the European Union Regional Development Fund, the Ports of Stockholm, the Port of Helsinki, the Port of Turku, the Port of Naantali and the Estonian government.

The report brings together the most essential results of all the PENTA work packages and recommendations for further action. The report is the result of the joint effort of all project partners. M.Sc. Elisa Holma (University of Turku/CMS) wrote chapter 1.2 and made figures 1.1 and 1.2. M.Sc. Anssi Lappalainen (University of Turku/CMS) wrote chapter 2 and was responsible for conducting the research on current and future transport flows between the PENTA ports and editing the report. M.A./M.Sc Maria Mustonen (Transport Research Institute TFK) wrote chapter 3 and was responsible for carrying out the research on noise. Chapter 4 was written jointly by Raivo Portsmuth, Tõnis Hunt and Kaidi Nõmmela (Estonian Maritime Academy), who were responsible for research on safety, security and administrative procedures. The coordinator of the PENTA project, Ph.D Johanna Yliskylä-Peuralahti, was responsible for writing chapters 1.1, 1.3 and 5.

The authors of this report would like to express their gratitude to all the people and organisations who participated in this study and to the financiers of the PENTATHLON project. Special thanks are devoted to the PENTA Steering Group for their active guidance.

Turku, August 5th 2013
PENTA project team

ABSTRACT

The ports of Stockholm, Tallinn, Helsinki, Naantali and Turku play key roles in making the Central Baltic region accessible. Effective, competitive, eco-friendly and safe port procedures and solutions for the transportation of goods are of major importance for trade in the Baltic Sea region. This report presents the most essential results and recommendations of the PENTA project, which focused on how ports could better comprehend and face current and future challenges facing carriage of goods by sea.

Each of the four work packages (WPs) of the PENTA project analysed the changes from a different perspective. WP2 focused on traffic flows between the PENTA ports. Its main emphasis was on the ports, shipowners, and logistics companies that are the key parties in freight transport and on the changes affecting the economy of those ports. In WP3 noise as an environmental challenge for ports was investigated and the analysis also shed light on the relationship between the port and the city. In WP4 procedures related to safety, security and administrative procedures were researched. The main emphasis was on identifying the requirements for the harmonisation of those procedures.

Collaboration is highlighted throughout this report. In order to prepare for the future, it was found that ports need to respond to growing competition, increasing costs and shifts in customer demand by strengthening their existing partnerships with other actors in the maritime cluster. Cargo and passenger transport are the main sources of income for most ports. Cargo traffic between the PENTA ports is expected to grow steadily in the future and the outlook for passenger traffic is positive. However, to prepare for the future, ports should not only secure the core activities which generate revenue but also seek alternative ways to make profit. In order to gain more transit traffic, it is suggested that ports conduct a more thorough study of the future requirements for doing business with Russia.

The investigation of noise at ports revealed two specific dilemmas that ports cannot solve alone. Firstly, the noise made by vessels and, secondly, the relationship between the port and the surrounding city. Vessels are the most important single noise source in the PENTA ports and also one of the hardest noise sources to handle. Nevertheless, port authorities in Finland and Sweden are held responsible for all noise in the port area, including noise produced by vessels, which is noise the port authority can only influence indirectly. Building housing by waterfront areas close to ports may also initiate disagreements because inhabitants may want quiet areas, whereas port activities always produce some noise from their traffic. The qualitative aspects of the noise question, cooperating with the stakeholders and the communicating of issues related to noise are just as important. We propose that ports should follow the logic of continuous improvement in their noise management.

The administrative barriers discussed in this report are mainly caused by differences in international and national legislation, variations in the customs procedures of each country, the incompatibility of the IT systems used in maritime transport, non-compliance with regulations regarding dangerous goods, and difficulties in applying

Schengen regulations to vessels from non-EU countries. Improving the situation is out of the hands of the ports to do alone and requires joint action on a variety of levels, including the EU, national authorities and across administrative borders.

TIIVISTELMÄ

Tukholman, Tallinnan, Helsingin, Naantalin ja Turun satamat ovat merkittävässä asemassa puhuttaessa Keskisellä Itämerellä tapahtuvasta meriliikenteestä. Rahtiliikenteelle suunnitellut tehokkaat, kilpailukykyiset, ympäristöystävälliset ja turvalliset satamatoiminnot sekä -ratkaisut ovat tärkeä osa Itämeren alueen kauppaa. Tämä raportti esittelee PENTA-hankkeen tärkeimmät tulokset ja suositukset, jossa selvitettiin miten satamat voisivat paremmin ymmärtää ja valmistautua nykypäivän sekä tulevaisuuden meriliikenteen haasteisiin.

PENTA-hankkeen neljästä työpaketista jokainen analysoi tulevia muutoksia eri näkökulmasta. Toinen työpaketti keskittyi liikennevirtoihin PENTA-satamien välillä. Painotus kohdistui satamiin, varustamoihin ja logistiikkayrityksiin rahtiliikenteen merkittävimpinä osapuolina, sekä muutoksiin jotka vaikuttavat yleiseen taloustilanteeseen. Kolmannessa työpaketissa käsiteltiin melua satamien ympäristöhaasteena sekä luotiin tämän pohjalta katsaus satamien ja kaupunkien välisille suhteille. Neljännessä työpaketissa tutkittiin turvallisuuteen, turvatoimiin, sekä hallinnollisiin toimenpiteisiin liittyviä seikkoja. Keskeisin tavoite oli osoittaa tarve menettelytapojen harmonisoinnille.

Yhteistyön merkitystä korostetaan raportissa kautta linjan. Jotta satamat pystyisivät valmistautumaan tulevaisuudenhaasteisiin, tulee näiden pystyä vastaamaan kasvavaan kilpailuun, nouseviin kustannuksiin ja muutoksiin kuluttajien kysynnässä vahvistamalla voimassa olevia kumppanuuksiaan meriklusterin sisällä. Rahti- ja matkustajaliikenteestä aiheutuvat tulot ovat pääasiallinen tulonlähde useimmille satamista. PENTA-satamien rahtiliikenteen odotetaan kasvavan tasaisesti tulevaisuudessa ja näkymät matkustajaliikenteelle ovat myös positiiviset. Valmistauduttaessa tulevaisuuteen ei tulisi ainoastaan keskittyä nykyisiin ydintoimintoihin vaan myös etsiä uusia tulonlähteitä. Kauttakulkuliikenteen kasvattamiseksi on suositeltavaa, että satamat tekevät perusteellisemman tutkimuksen Venäjän liiketoiminnan tulevaisuuden vaatimuksista.

Satamamelun tutkiminen paljasti kaksi dilemmaa, joita satamat eivät pysty yksin ratkaisemaan. Ensimmäinen ongelma on aluksista lähtevä melu ja toinen ongelma on sataman ja sitä ympäröivän kaupungin välinen suhde. Laivat ovat suurin yksittäinen melunlähde PENTA-satamissa ja samalla yksi vaikeimmin pienennettävissä olevista. Siitä huolimatta satamaviranomaisia pidetään vastuullisina kaikesta satama-alueella syntyvästä melusta Suomessa ja Ruotsissa – mukaan lukien alusmelu johon satamat eivät suoraan voi vaikuttaa. Asutuksen rakentaminen meren ääreen ja satamien lähelle aiheuttaa myös erimielisyyksiä, sillä asukkaat kaipaavat usein hiljaisuutta ja satamatoiminnot aiheuttavat aina jotain melua. Melukysymyksen laadulliset näkökulmat, yhteistyö eri toimijoiden kanssa ja meluasioista keskusteleminen ovat kaikki tärkeitä asioita. Raportin suositus on, että satamien tulisi tehdä jatkuvia pieniä parannuksia melun hallinnassa.

Raportissa käsiteltävät hallinnolliset hidasteet johtuvat pääasiassa maiden välisistä laintulkinnoista ja niiden eroavaisuuksista, tullimenettelyistä, merenkulkualalla käytettävien IT-järjestelmien yhteensopimattomuudesta ja muista sääntöjen

tulkintaeroista. Satamat eivät pysty yksin parantamaan tilannetta vaan se vaatii yhteisiä ponnisteluja Euroopan Unionissa, kansallisella tasolla sekä eri hallinnollisten toimijoiden välillä.

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1 INTRODUCTION

1.1 Aims and scope of the PENTA project

Changes in economic structures, the business environment, the travel and leisure patterns of people as well as the development of international and national legislation set continual challenges for ports. The ports of Stockholm, Tallinn, Helsinki, Naantali and Turku play key roles in making the Central Baltic region accessible. The purpose of the PENTA project was to explore alternatives and develop measures to better comprehend and face current and future challenges concerning maritime transport, while simultaneously increasing the competitiveness of the ports. This report contains the main results of the following three work packages: WP2 Cargo and passenger flow development scenarios; WP3 Environmental actions; and WP4 Safety, security and administrative procedures. Recommendations, based on the results of each work package, are also presented.

The strategic focus of WP2 is to prepare the PENTA ports for a changing business environment and thus guarantee the future competitiveness of the ports. An analysis of the cargo and passenger flows in the Baltic Sea region (BSR) was made on the routes between the PENTA ports, and the results are presented in the report "Drivers of demand in cargo and passenger traffic between PENTA ports". The future scenarios of the development in cargo and passenger traffic were developed on the basis of PESTE methodology. Those scenarios are presented in the report "Scenario-based traffic forecasts for routes between the PENTA ports in 2020." In the report, proactive measures and recommendations that were developed with and between the ports, partners and other stakeholders are presented.

PENTA WP3 is a contribution to the sustainable development objective of the Central Baltic Programme. Noise is one of the top environmental concerns of European ports today. Thus, gaining an understanding of this problem and finding new ways to handle it will be essential for the future development of all ports. The impact of noise can, in the worst case, force ports to limit their operations, constraining their economic growth potential. Raising awareness of the complexity of the noise question was the starting point of WP3 and finding ways to cooperate for a noise-free environment remain a major aim.

Effective, competitive, eco-friendly and safe port procedures and sea transportation solutions are of major importance for trade in the Baltic Sea region. In WP4 the current situation concerning safety, security and administrative procedures in the ports was analysed. A literature review on international and national legislation on safety and security was conducted and two questionnaires addressed to ports and other maritime stakeholders were also conducted in order to map current bottlenecks. Two reports "Analysis of barriers caused by administrative, security and safety procedures in Pentathlon" and "Analysis of influence of forthcoming requirements on security, safety and administrative procedures in Pentathlon" were published.

The University of Turku, Centre for Maritime Studies (CMS) was responsible for the overall coordination of the project activities and its management, including the monitoring of the progress of the project; reporting; communication with project partners, the project's steering group and other stakeholders; the dissemination of the project's results; and the arrangement of meetings and workshops. The project was financed by the Central Baltic INTERREG IV A Programme 2007-2013 of the European Union Regional Development Fund, the Ports of Stockholm, the Port of Helsinki, the Port of Turku, the Port of Naantali and the Estonian government. The report reflects the views of the authors. The Managing Authority of the INTERREG Central Baltic IV A Programme cannot be held liable for the information published in this report.

1.2 Definition of a port and the focus of the PENTA work packages

Ports that operate as gateways have always been sensitive to changes in socio-economic trends. Over the course of time, ports have developed into a complex concept, which has no unambiguous definition. Hence a definition of what constitutes a port is required. According to the strictest definition, a port is a restricted physical area, or a physical area and its infrastructure, but, according to a wider definition, a port can be considered an entity of actors providing services for passenger and cargo traffic inside a port's perimeters (Karvonen & Tikkala 2004).

The port concept can vary depending on approach, but when speaking of a port, it rarely refers only to a port authority, which according to most definitions, is underlined by its landlord and regulatory function, although other functions also exist (Verhoeven 2011). Commonly the port concept includes the entire port community, consisting of several enterprises and authorities operating in the port area. Port entities are consortiums of many actors in the fields of different modes of transport: logistics service producers, cargo handling and authorities operating under international, national and local regulations.

In the PENTA project, a port is regarded as an entity of enterprises and authorities closely intertwined in port operations in the port area (Fig 1.1). At the core of the port concept is the port authority and the stevedoring companies which provide the physical framework for cargo handling. These work in close connection with the logistics companies operating both in maritime and land transport, including shipping companies, shipping agencies, freight forwarders and land transport enterprises and authorities serving traffic, including border guards, pilotage and customs. Together these comprise a port community of different actors. Their operations are regulated in international and local regulations and national legislation and they need smooth, effective information exchange for the port to work effectively. Port-related operations require vast areas, produce noise, and they are often located near residential or other areas of social activity. Hence, ports also affect surrounding communities, which must be taken into consideration by city planners and architects and the port authorities.

In the work packages of the PENTA project, different aspects of a port's community and its operational environment were researched. The four work packages of the project have a different thematic focus in their approach to the port concept: WP2 focuses on traffic flows, WP3 on the interface of the port and the city and WP4 on administrational and legislative issues (Fig 1.1). WP2 concentrates on passenger and cargo flows through the PENTA ports and their development in the future, thus it focuses on logistics companies operating in both maritime and land transport. The present state of traffic in the PENTA ports and the drivers affecting on traffic flows in the future are analysed in this work package. In WP3, the port concept is approached from the viewpoint of the interface between the port and the local neighbourhoods and communities it borders. WP3 studies the challenge of combining port activity with the wishes of wider society, such as housing and the issue of noise as an environmental challenge and how it is managed and regulated. In WP4, the administrative and regulatory means to respond to changes in socio-economic trends and port obligations are discussed, the main issues are procedures related to safety, security and administration between organisations. In other words, the focus is on regulations and co-operation between authorities. In the project coordination work package (WP1) the results of WP2, WP3 and WP4 are summarised to present a comprehensive approach to the concept of a port.

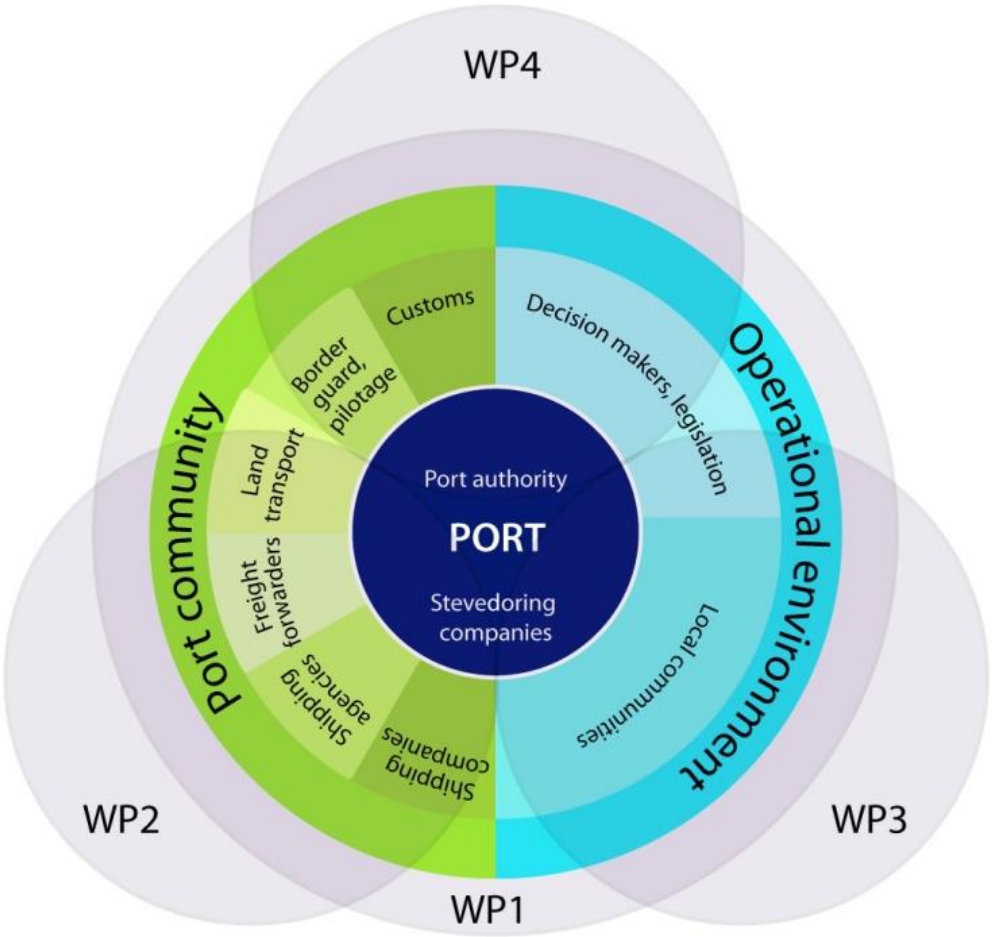

Figure. 1.1. Port communities and their operational environment, and the focus of each PENTA WP.

1.3 PENTA ports

Countries in the Baltic Sea region have strong trade relations with each other. Efficient transport and logistics solutions are needed to get goods to market. The role of ports is crucial for interconnectivity, economic growth and sustainability in the Baltic: they enable both cargo and passenger mobility.

The ports of Stockholm consist of the ports of Stockholm, Kapellskär and Nynäshamnen. The central harbours located in the city of Stockholm – Stadsgården, Frihamnen and Värtahamnen – handle both goods and passengers travelling between Sweden, Finland and the Baltic countries. Kapellskär is located 90 km north of Stockholm and it serves freight traffic that moves between Sweden, Finland and Estonia. The port of Nynäshamn is located 60 km south of Stockholm, serving traffic between mainland Sweden and the island of Gotland, and the traffic between Sweden and the Central and the Southern Baltic Sea region (The ports of Stockholm 2013).

The port of Tallinn consists of five separate harbours: the Old City Harbour in Tallinn, Muuga, Paljassaare, Paldiski South and Saaremaa. The Old City Harbour mainly functions as a passenger harbour, but also handles RoRo cargo carried between Estonia, Finland, Sweden and Russia. Muuga harbour, the biggest harbour in Estonia, is located 20 km east of Tallinn and is specialised in handling transit traffic: containers, solid and liquid bulk goods, general and RoRo cargo. Paljassaare handles break bulk, coal, oil products, timber and perishables. Paldiski South is located 45 km southwest of Tallinn and serves Estonian foreign trade and also transit traffic via Estonia. Saaremaa serves passenger traffic, recreational vessels and cruise ships (Port of Tallinn 2013).

The port of Helsinki handles imports and exports and also passenger traffic between Finland, Estonia, Sweden, Russia, Poland and Germany. Cargo arriving at the port of Helsinki consists mainly of consumer durables and foodstuffs as well as raw materials and semi-finished goods for industry. The export goods mainly comprise the products of forestry and the metal industry as well as foodstuffs, textile products and glassware (Port of Helsinki 2013).

The ports of Turku and Naantali serve freight traffic to and from Scandinavia and Central Europe. The Port of Turku mainly serves RoRo and passenger vessels and cruise ships, but also it has facilities for loading and unloading containers, general cargo and other types of cargo. The Port of Turku is the leading passenger harbour for Scandinavian traffic and the second largest passenger port in Finland measured by total number of passengers. The port of Naantali has several daily services to Scandinavia and Northern Europe, including a fast regular service connection to Kapellskär in Sweden. The main volumes for the port of Naantali include liquid and dry bulk and RoRo cargo.

The location of the PENTA ports is depicted in figure 1.2. All PENTA ports have frequent liner connections to each other and several daily departures. Stockholm, Helsinki and Tallinn are capitals serving their respective metropolitan regions and have the highest populations and company concentrations.

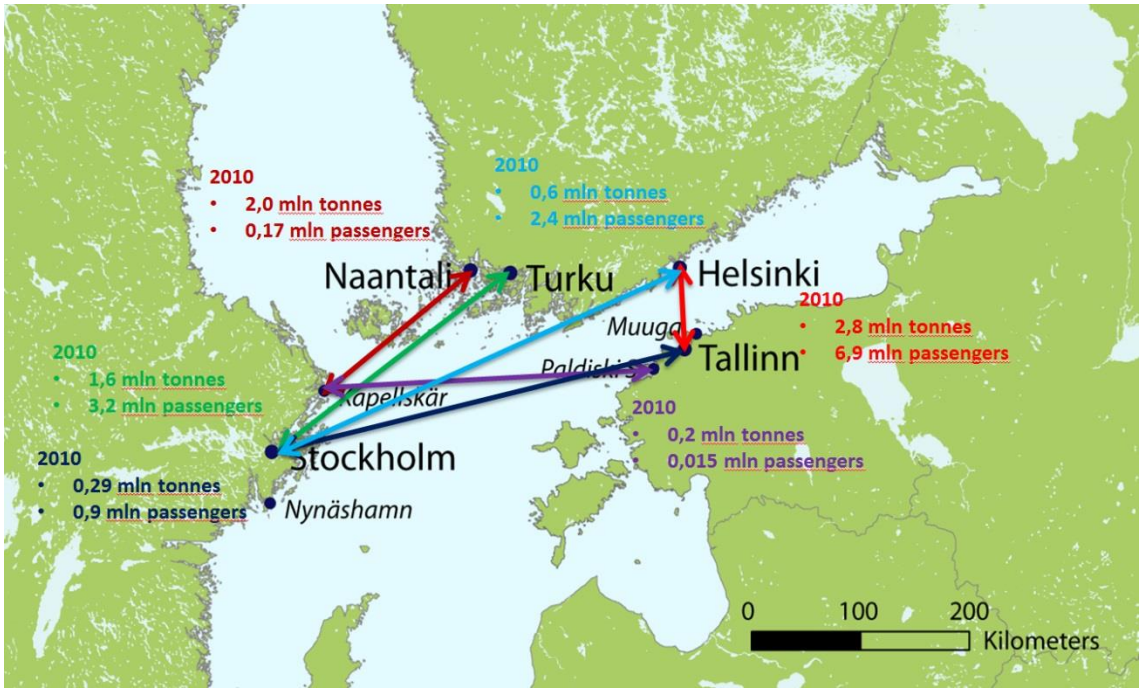

Figure. 1.2. PENTA ports.

In terms of cargo and passenger volumes, the busiest route among the PENTA ports – with over 10 departures daily and even 17 during summertime – is the route between the Port of Helsinki and the Port of Tallinn. In 2010, nearly 3 million tonnes of cargo and 7 million passengers were transported between these cities. The route between Kapellskär and Naantali favours truck transportation companies with 2 million tonnes of cargo, but it also has 170,000 passengers a year. Finnlines operates 3 daily departures in both directions.

There are five scheduled departures in both directions between the Port of Stockholm and the Port of Turku per day and 1.6 million tonnes and 3.2 million passengers move between the ports annually. The route between Stockholm and Helsinki is used to minimise road transportation in Finland but with 2.4 million passengers annually it is still very popular among tourists and leisure travellers. Due to the long distance, this route has only two departures per day. Traffic between Sweden and Estonia is not as high as the others but the route has great potential. The route between Stockholm and Tallinn has one or two departures daily, moving nearly 300,000 tonnes of cargo and one million passengers annually, whereas the route between Kapellskär and Paldiski carries 200,000 tonnes of cargo and 150,000 passengers annually. The latter route also has one to two departures per day.

A more detailed description of the ports and their current situation can be found in the reports: “Drivers of demand in cargo and passenger traffic between PENTA ports”, “Analysis of barriers caused by administrative, security and safety procedures in Pentathlon” and “Scenario-based traffic forecasts for routes between the PENTA ports in 2020”.

2 ADAPTING TO CHANGING CARGO AND PASSENGER FLOWS

This chapter points out the main future challenges on the basis of the main findings of the previous PENTA WP2 reports: "Drivers of demand in cargo and passenger traffic between PENTA ports" and "Scenario-based traffic forecasts for routes between the PENTA ports in 2020". The main focus is on two aspects: documenting current traffic flows and highlighting future changes. The most significant changes that will create challenges for the ports are discussed from the point of view of their economic effect. The chapter ends with discussion on future challenges and recommendations for how ports could proactively adapt to changes.

2.1 The present situation

On the busy Baltic Sea, cargo and passenger flows are changing. This concerns the volumes, the amount of transported units, passenger numbers, the share of transit traffic, vessel frequency and routeing. There are many reasons for these changes and most of them are related to financial considerations, such as the economic health of nations and the cost efficiency of the maritime transport industry. GDP growth in nations enables an increase in consumer demand, while manufacturing in low-cost countries generates new possibilities in terms of logistic solutions and supply chain management. As a result, the operation of the companies involved in foreign trade and transportation is changing as well. The important questions are (1) What does the future hold? (2) How should companies prepare for the future? These questions include the need for and supply of cargo handling capacity, personnel, offered products and services, and investment.

2.1.1 Sea transportation supply chain

The operation of the transportation industry is multidimensional. The transportation supply chain includes many participants from different fields and the geographical location of each member is crucial in appealing to customers, being cost-effective and making a profit. In the PENTA project – and in sea transportation in general – the ports, shipowners and logistics companies are the key parties in maritime transport (Figure 2.1).

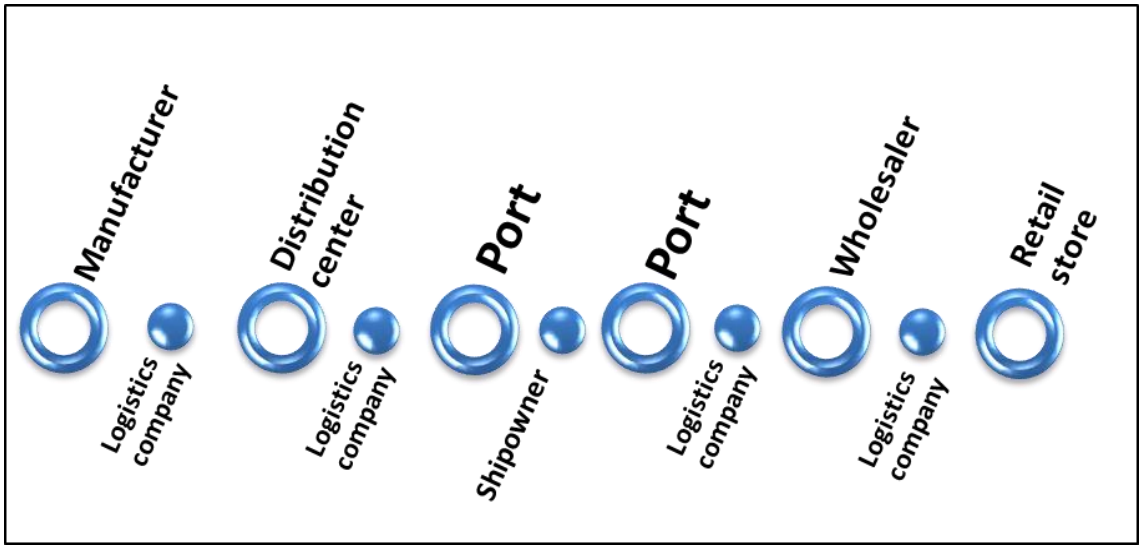

Figure 2.1. Different parts in the sea transportation supply chain.

2.1.2 Global trends

The sea traffic of the Baltic Sea is also significant from a broader, global perspective. Thus, attention must be also paid to global variations or global changes in sea traffic, which are called trends or megatrends (EEA 2010). These broad, long-term trends are often affected by several smaller and parallel trends. Partly due to this, global megatrends can be seen in maritime transport over the Baltic Sea as well. The most significant current changes in cargo traffic in the Baltic have arisen as a result of the economic growth of Russia, the Baltic States and Poland. On a global scale, the economic focus is increasingly moving towards Asia. Industrial production is increasingly being relocated from Europe to Asia and from Western Europe to Eastern Europe. Those changes in are also causing trade imbalances that are clearly visible in the transport of goods between Europe and Asia. In the Baltic Sea, oil is Russia's main export but consumer goods and cars its main imports.

There are a number of trends related to economic, social, environmental and political issues that also affect ports. For example, the demand for energy is increasing, leading to a growth in the price of transportation. Climate change and regulations regarding emissions will further increase the share of renewable fuels used as an energy source during transportation. In relation to that, increasing environmental pollution is forcing politicians to create new rules and regulations regarding the pricing of fuel and energy sources. Technological advances are also increasingly enabling online-interaction, and, in population trends, people are aging and living in a more urbanised world (Mäkelä et al. 2011).

2.1.3 Factors affecting the operational environment

Economic growth is considered to be the most important factor affecting future traffic flows. According to the current outlook, economic growth in the Baltic Sea region is expected to be only moderate until year 2020 and this will keep cargo flows on a rather low level. On the other hand, the effect on passenger traffic may be completely the opposite since tourists are seeking for more affordable travel alternatives than before. Rising bunker costs are considered the second most important factor affecting the operational environment in PENTA. The expectancy is that bunker costs will double by 2020, regardless of the upcoming sulphur directive, but a growth in other costs is also possible. This will have a direct impact on the operational costs of the shipowners, which, in turn, affects the cost of freight.

The impact of the sulphur directive has produced many different opinions on its likely effects and results, and these opinions differ according to industry, organisation or company. For exporting industries it is seen as resulting in higher logistics costs, while environmentalists see it as one step towards cleaner air and better human health. However, there is agreement that once the sulphur directive takes effect as planned in 2015, a new directive that overrides it is very unlikely. The significance of the sulphur directive cannot be exaggerated when future traffic flows are analysed. The price of marine fuels is estimated to increase by between 50% and 70%, leading to an increase in the cost of maritime transport by up to 30%. This will result as an increased use of roads in the Baltic States and Sweden to avoid expensive shipping. On the other hand, this will create new opportunities, especially for the shipowners, since the Baltic Sea – as a SECA area – will increasingly become protected from the external competition.

Future trade in BSR will be very much determined by an expected high growth in trade between Russia and Germany. As the visibility of Russia as a trade partner increases, the traffic between Baltic Sea countries and Asia is least likely to increase, but intra-EU trade is expected to remain strong. The growing Russian economy and the effect it will have on the PENTA ports divides the opinion of experts. In general, the ports believe that strong economic growth will increase traffic via PENTA ports rather than decrease it. The views of the logistics companies, on the other hand, are quite the opposite. Russian port infrastructure, supply chain management, and warehousing are all improving which is expected to lead a decrease in transit traffic.

2.1.4 Present routes between PENTA ports

The PENTA project focuses especially on liner traffic with at least one daily connection to a destination. The routes are operated with ferries, RoRo-, and RoPax-vessels. The importance of the current routes for a single port varies depending on the structure of the transported goods in each port. In terms of cargo volumes, the Swedish ports have reliable traffic with other PENTA ports, with shares of 96% in Stockholm and 98% in Kapellskär (Figure 2.2). The main commodities in the ports of Tallinn and Naantali are liquid cargo or oil products which is why the share of PENTA traffic seems rather low. In terms of transported tonnes between the PENTA ports, however, Tallinn and

Naantali are significant. The majority of the cargo traffic in the Port of Tallinn is also transit. The port of Helsinki is the main port for Finnish import-export traffic and has multiple connections to other ports. The Port of Turku has also frequent connections to Germany.

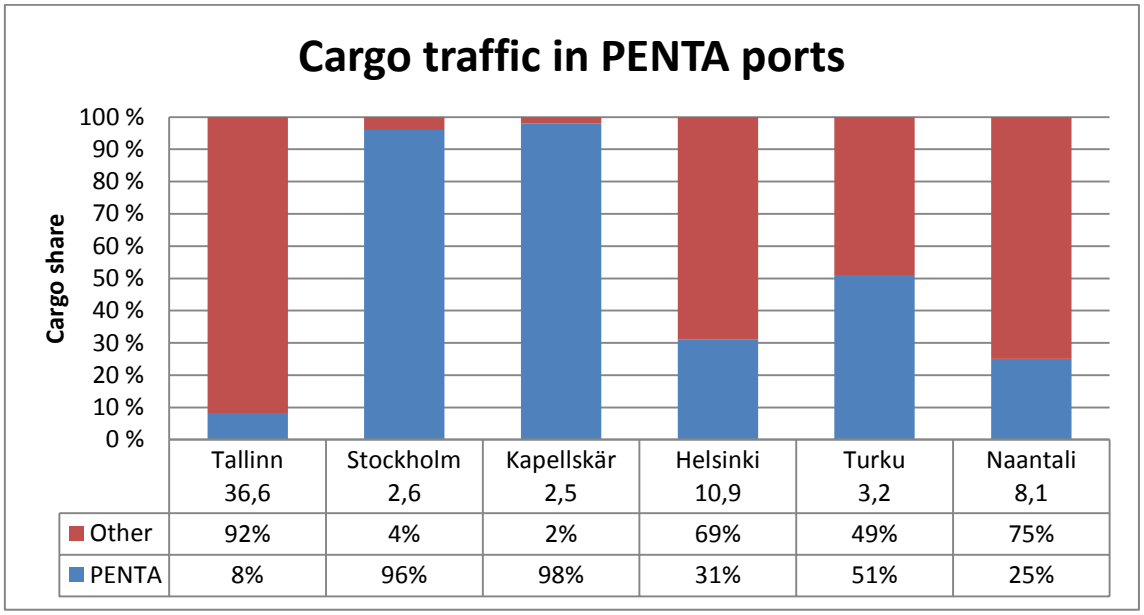

Figure 2.2. Cargo traffic in PENTA ports in 2010 (per million tonnes). Sources: Port of Tallinn, Ports of Stockholm, Port of Helsinki, Port of Turku, Port of Naantali, MARTINA-database.

With regard to passenger flows, traffic between PENTA ports is also significant. In general, passenger traffic concentrates on short distances, but the PENTA ports also have other connections besides those between themselves. The passenger traffic to the ports of Tallinn and Naantali is mostly from other PENTA ports. The majority of traffic to the ports of Turku and Helsinki also comes from other PENTA ports. The Ports of Stockholm also have many connections to Russia and to other Baltic States than Estonia. One point to remember when analysing the passenger traffic shares in Figure 2.3 is that Mariehamn and Långnäs are located directly between most of the routes. Due to this, the calculation of the amount of actual passenger traffic is difficult since every port travels to those ports on Åland.

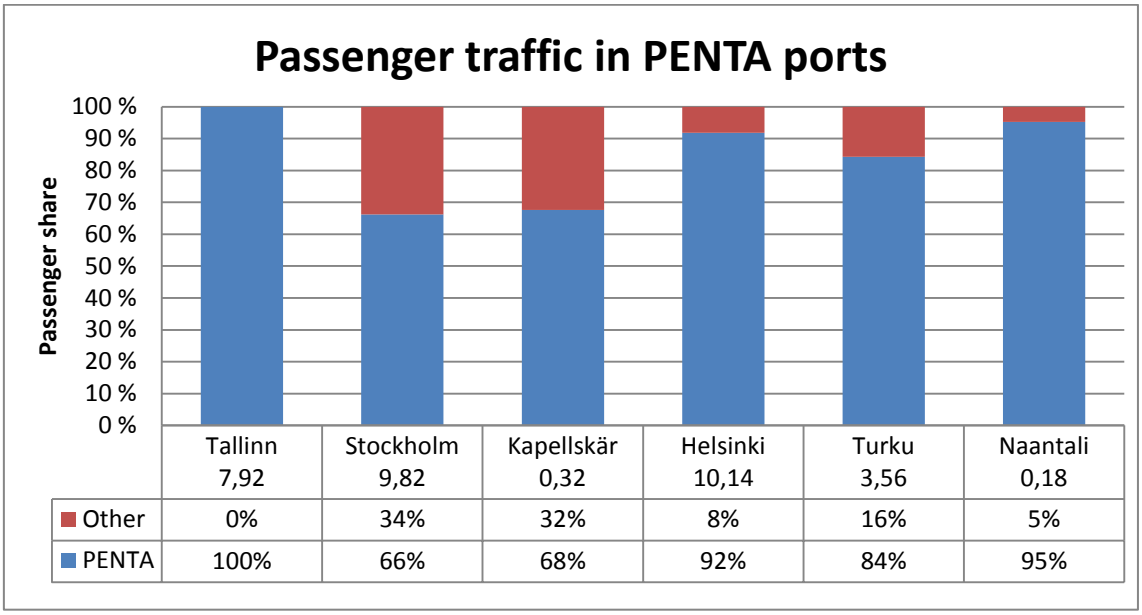

Figure 2.3. Passenger traffic in PENTA ports in 2010 (per million passengers). Sources: Port of Tallinn, Ports of Stockholm, Port of Helsinki, Port of Turku, Port of Naantali, MARTINA-database.

The following chapters and figures describe the development of PENTA-related traffic in each port. The progress is analysed by combining all PENTA traffic flows between 2000 and 2010, which helps provide the estimate of the traffic in 2020.

Cargo traffic

Cargo traffic on routes between PENTA ports altered greatly in the time frame analysed (Figure 2.4). In 2000, the Port of Stockholm was by far the biggest port – when measuring the amount of transported tonnes between the PENTA ports. However, freight traffic between the Port of Turku and the Port of Stockholm decreased during that time, while cargo traffic between Helsinki and Tallinn increased tremendously – making them the biggest ports in 2010, when measuring the amount of transported tonnes between PENTA ports. Cargo traffic between Kapellskär and Naantali also increased steadily from 2000 onwards, but the total traffic amount of traffic in Kapellskär is larger due to the increase in traffic arriving from Paldiski.

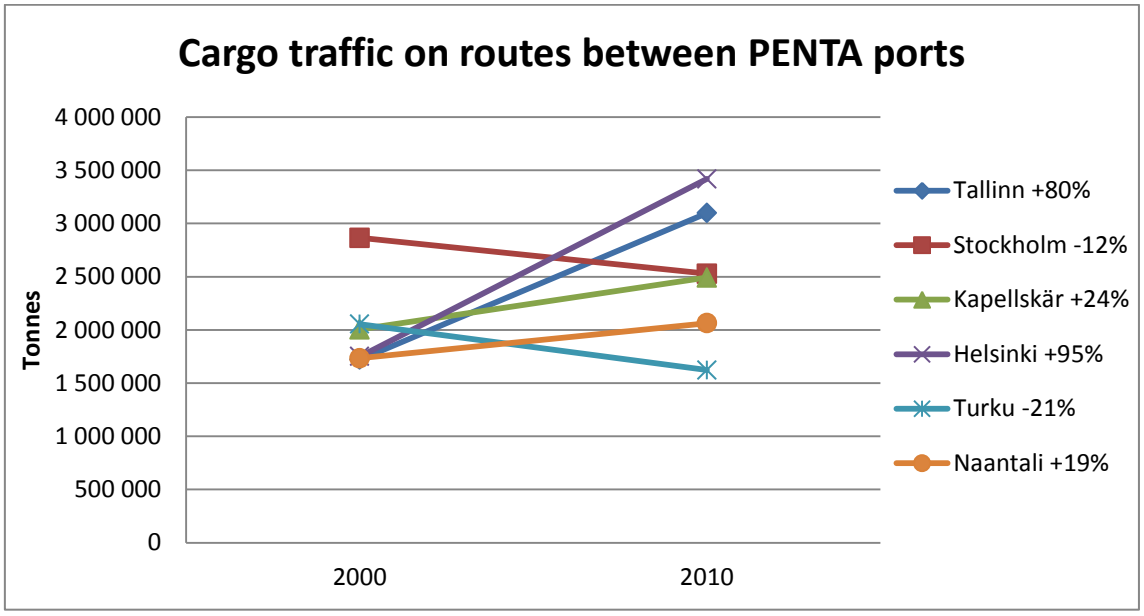

Figure 2.4. Cargo traffic on routes between PENTA ports.

Unitised traffic

The developments in unitised traffic have followed the patterns of those in total cargo volumes. The only difference is that the increase was faster compared to the actual growth of freight traffic and that the decrease was not as rapid (Figure 2.5). Amongst the PENTA ports, the Port of Tallinn and the Port of Helsinki already have many more units compared to the other ports and this gap will become more apparent in future.

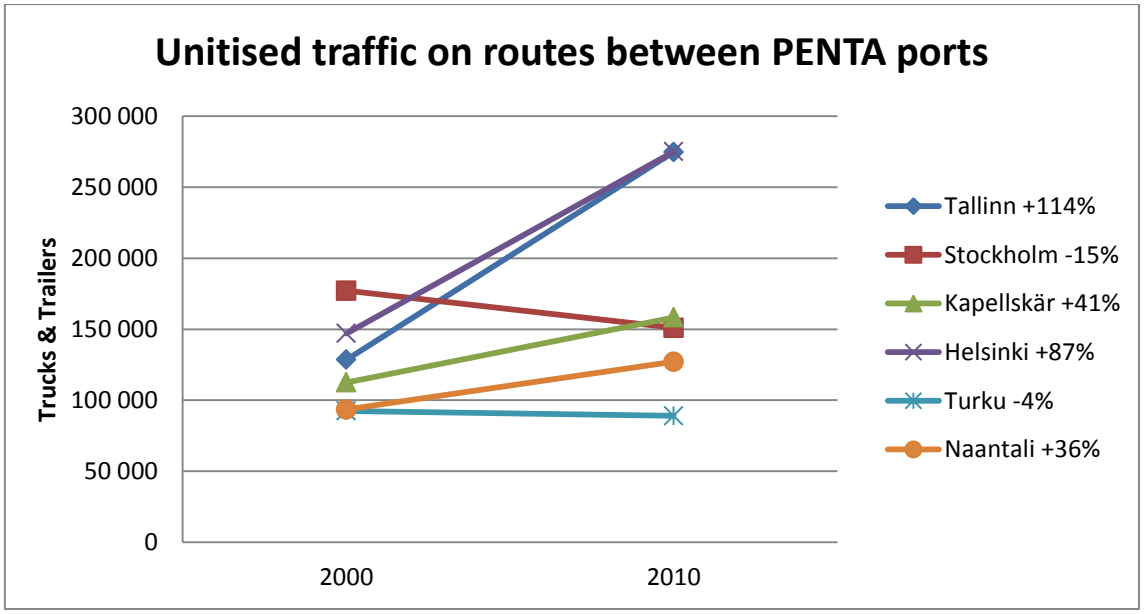

Figure 2.5. Unitised traffic on routes between PENTA ports.

Passenger traffic

The changes in passenger traffic have been less dramatic compared to the changes in cargo volumes and transported units. Figure 2.6 presents the importance of passenger traffic on routes between the PENTA ports. The amount of passengers increased in the time period measured, especially in the Port of Tallinn and the Port of Helsinki, whereas the traffic in Turku and Stockholm slowly decreased. The significance of passenger traffic in Kapellskär and Naantali is rather low.

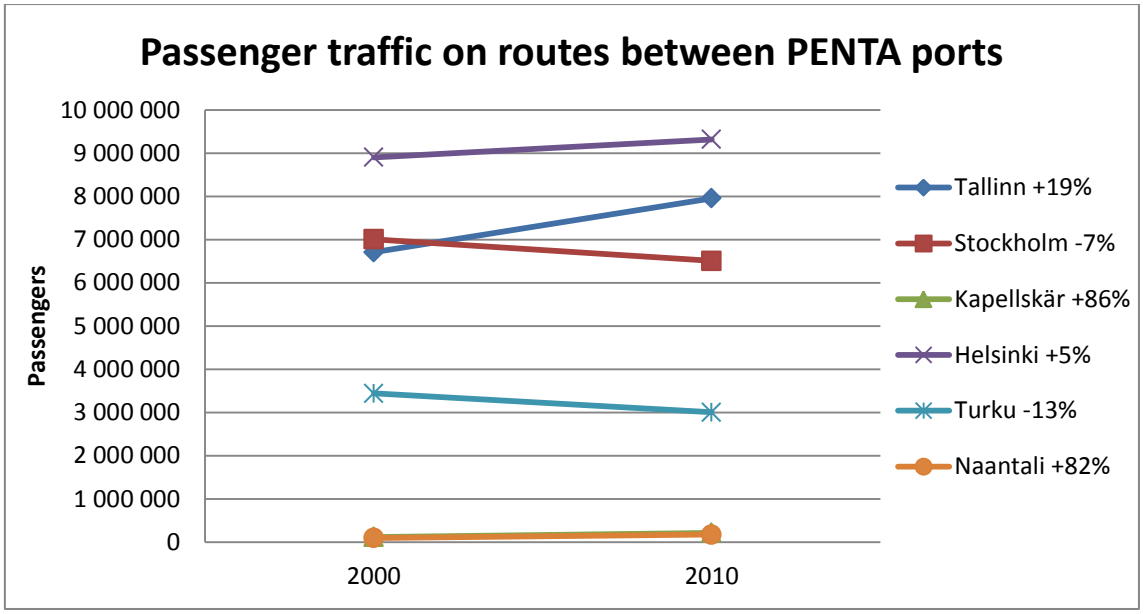

Figure 2.6. Passenger traffic on routes between PENTA ports.

Vessel calls

The number of vessel calls on routes between PENTA ports has also decreased. The change has been most visible in the Port of Helsinki where small vessels have been steadily replaced by larger ferries operated by Viking Line, Tallink Silja and Eckerö Line. In Figure 2.7 please note that the Port of Helsinki could only provide information related to vessel calls since 2007. The port of Kapellskär is the only exception among the PENTA ports where the increase in traffic to Paldiski harbour has increased the number of port calls.

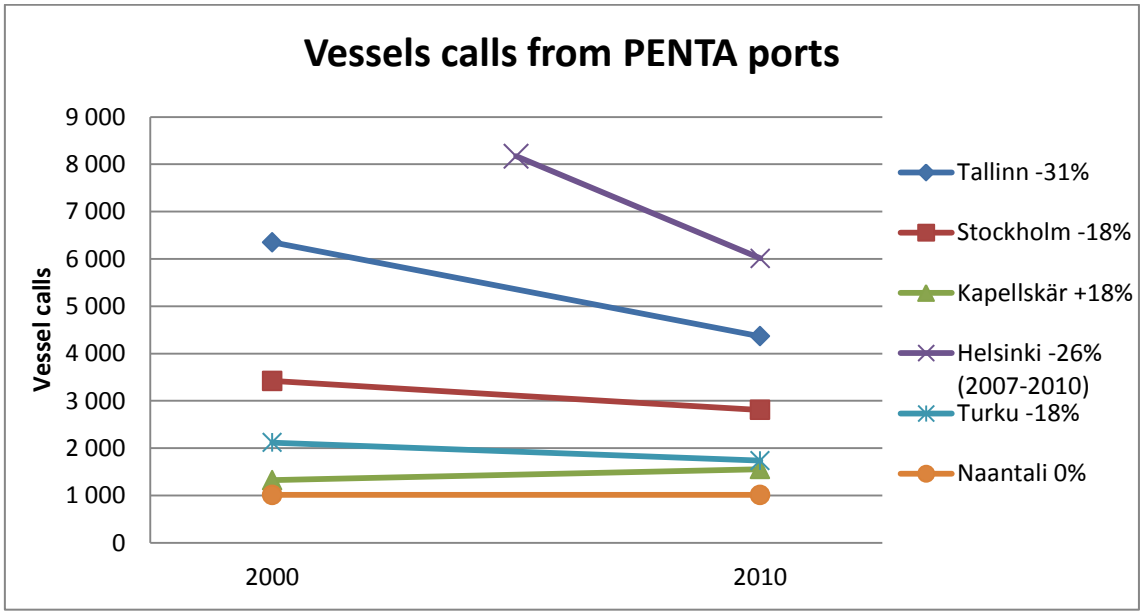

Figure 2.7. Vessel calls from other PENTA ports.

Figure 2.8 below presents the increase in average vessel sizes visiting the PENTA ports. This is also the main reason for decreasing vessel calls since more cargo and passengers can now fit into a single vessel. The increase in average ship size has been greatest in the ports of Tallinn and Helsinki, where the average vessel size increased by over 100% from 2000 to 2010. The growth in ship sizes was lowest in the Port of Turku, where the decrease in vessel calls was modest as well. Unlike the other figures in this report, Figure 2.8 includes all traffic arriving and not only those from PENTA ports.

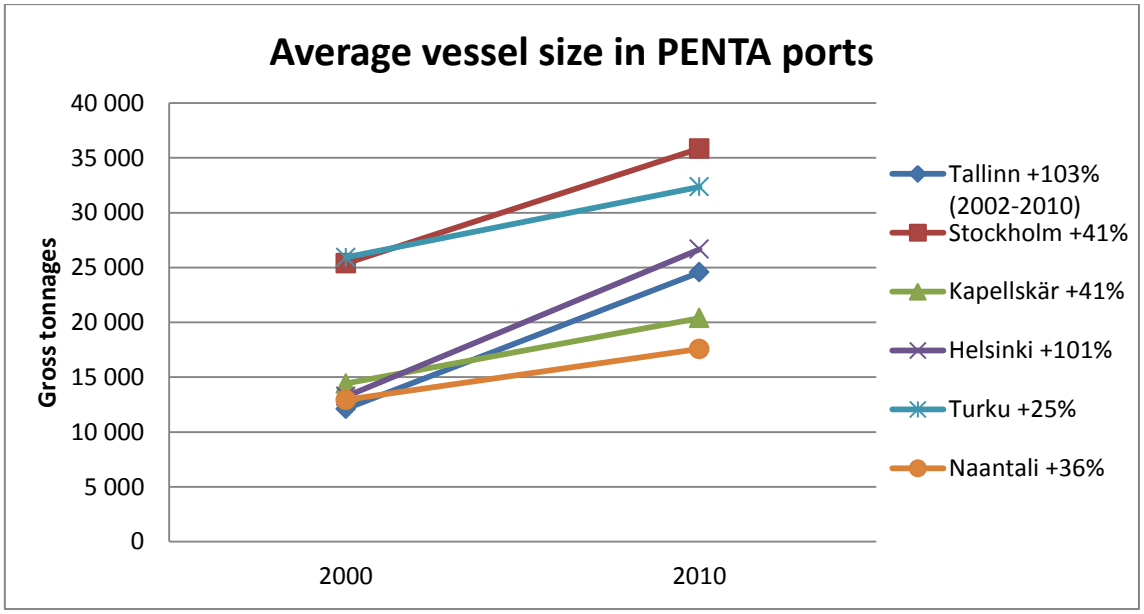

Figure 2.8. Average size of the vessels arriving at PENTA ports. Source: Eurostat.

2.1.5 Port economy

Besides transporting goods, the PENTA ports are also companies which aim to make a profit. The turnover of a port is primarily based on the size of traffic and existing pricing agreements. Port pricing is an issue that deals with several topics at once and takes into consideration, port capacity, competition, strategy, policy and regulations, for example. Depending on a port's objectives – as well as finance and costs – the methods used to set port pricing can vary between cost-based pricing, congestion pricing and strategic pricing (Bichou 2009).

Pricing methods

1. Cost-Based pricing

Due to the wide range of port activities, the structure of port prices depends on the cost classification of these services. The set of cost components includes internal and external costs, fixed and variable costs, and average versus marginal costs. Because of the multidimensionality of a port's costs, cost-based pricing can be divided into three sub-categories.

1.1. Marginal cost pricing

The objective of marginal cost pricing is to maximize the social surplus and to allocate resources efficiently. This approach is used to charge the user for external costs and to set a benchmark for the efficient utilisation of port resources – subject to perfect market conditions.

1.2. Average cost pricing

When infrastructure costs must be covered, a charge to the user equal to the average port cost should be applied. In this case the total costs and revenues are set to be equal to the sum of the financial costs, and the cost recovery price is set to correspond to a break-even or a return-on asset value. In order to fully recover port investments, the differing cargo-types and shipping services are treated equally and no consideration is given to the structure of resource costs.

1.3. Multi-part tariff pricing

Multi-part tariff pricing recognises that in an industry marked by economies of scale, levying will give rise to financial deficits. For example under two-fare pricing, charges may be designed so that one part pays for the fixed cost and the other part for the variable cost. This may lead to price discrimination but it also helps in minimising the loss of benefits in relation to marginal cost pricing.

2. Congestion pricing

The second pricing method, congestion pricing, suggests levying a congestion surcharge to users in order to reduce port congestion. By doing this, congestion pricing combines both demand-based and variable-cost strategies, making it possible to regulate port demand without simultaneously increasing supply, which would require port users to pay for the negative externalities they create.

3. Strategic pricing

The third pricing method, strategic pricing, is based on the premise that pricing can be used as a tool to promote port competition and attract customers. This requires a certain degree of price discrimination, for instance by shipping service, type of traffic and the value of cargo.

Revenue structures

Without full knowledge of the pricing methods used in the PENTA ports and the expenses caused by their operations, a comprehensive analysis of the ports' revenue structures would be inaccurate. However, what is easy to identify is the correlation between traffic flows and the main income sources in each port. This approach enables the identification of the most important traffic flows and port activities in financial terms and also provides support for the recommendations made in the final chapter.

The dominance of cargo traffic in Naantali and Kapellskär is clearly visible in the ports revenue structures in Figure 2.8. In the Port of Stockholm, passenger traffic as a source of income generates roughly 40% of the port's turnover but the share of cargo traffic is only around 15%. The revenue structures in the ports of Turku and Helsinki are divided very equally between different sources of income. In the Port of Helsinki, cargo traffic is the largest individual source of income, whereas in the Port of Turku vessel payments and rental income both have large shares. The largest source – as a generator of profitable income – in the Port of Tallinn is port dues, which has a share of over 60%. Without detailed information, our ability to determine what is included in the port dues, the shares of cargo and passenger traffic – as the generators of turnover – is limited.

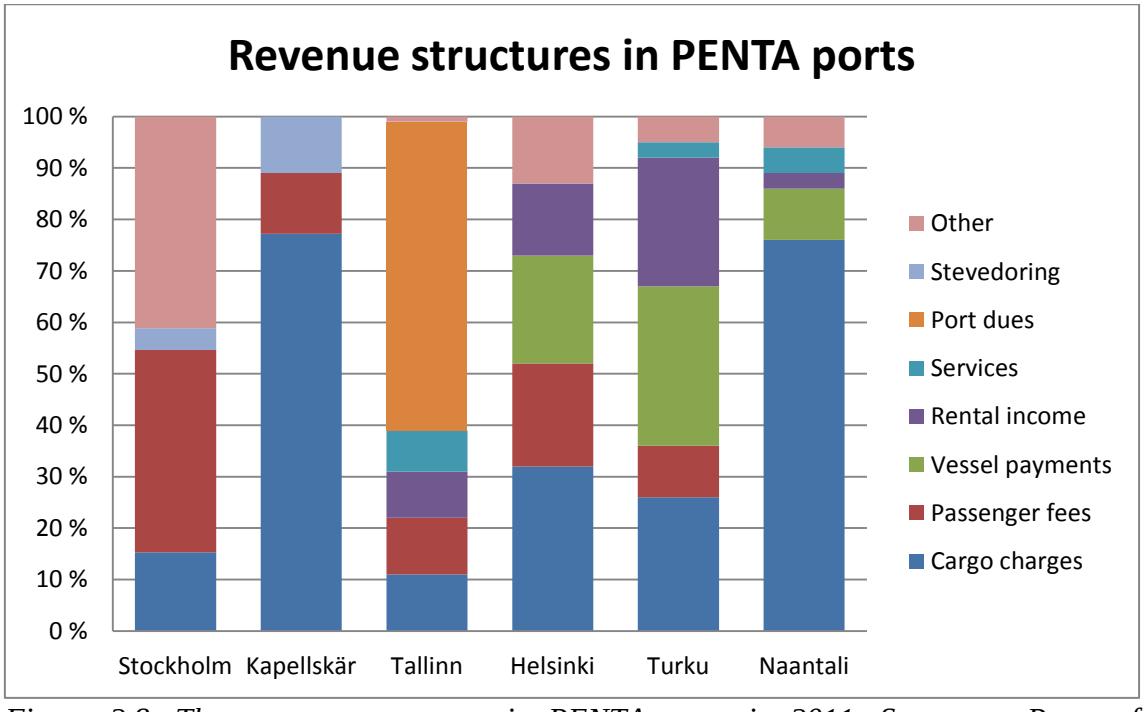

Figure 2.8. The revenue structures in PENTA ports in 2011. Sources: Ports of Stockholm, Port of Helsinki, Port of Turku, Port of Naantali, Port of Tallinn.

2.2 Proactive measures and recommendations

This chapter suggests proactive measures and makes recommendations that should help to maintain port traffic flows at a high level, while keeping port operations profitable in the future. At all times ports should be thinking of the future they desire and working to achieve that according to their vision and strategy. On-going tasks also include creating new relationships with and connections to other ports and cities, thus creating the foundations for new routes that can attract shipowners. This is one of a port's most important missions. In order to increase competitiveness – especially in this currently weak financial climate when traffic flows and profits are decreasing – port expenses should be cut and the balance sheet should be reduced. These measures free capital, reduce the risk of bankruptcy and increase freedom of action.

2.2.1 Future challenges

The industry, the owners of transported goods and the payers of the freight often perceive logistics as a necessary evil, even though it should be considered as one of the factors generating a competitive edge. Transport services are invited to tender bids but the operators and other parties of the transport chain are not seen as strategic partners.

The main challenge for the ports is maintaining cargo and passenger traffic and vessel frequency at a high level and mutually preventing the decrease of transported units. However, influencing freight volumes can be difficult since ports act only as gateways and other factors, such as the economy and GDP growth, are also significant drivers generating cargo traffic. On the other hand, increasing the relative share of freight transport in a certain port is possible by creating a competitive environment for operations. Passenger traffic can also be affected by the marketing, promotion and generation of new routes.

Cargo traffic in general is expected to increase in the long run. Within the PENTA project, the freight volumes are relatively easy to identify and, depending on the route, they are increasing, stable or decreasing. The increase of transported units is faster compared to the actual growth in transported tonnes. This is because consumers and end-customers require a steady supply of products. Hence, increasing the delivery frequency, even though the unit-specific transportation costs are higher is profitable. The future of transit traffic is not unambiguous. The main factor affecting transit flows in PENTA is the rising economy of Russia and the development of the Russian Baltic Sea ports. Russia's developing economy will require more goods transportation but, on the other hand, Russia is aiming to reduce its dependency on neighbouring countries with regard to Russian import-export traffic.

Passenger traffic between PENTA ports has always been significant and there are no signs that this will change. The amount of passengers on routes going to Tallinn has increased in recent years, and this has partly resulted in a decrease in more traditional routes between Finland and Sweden. Vessel frequency on routes between PENTA ports is stable except for traffic between Helsinki and Tallinn.

2.2.2 Guidance

In order to maintain a profitable business, companies have alternative visions and plans for potential future changes. The first option is not to react and to presume operations will continue as before. The second approach is reactive and requires the adaptation of current operations in order to meet future needs. The third option is a proactive approach whereby ports try to produce change by creating demand, establishing new relations, attracting shipowners, offering new routes, etc. The first step is the acknowledgement of whether a predicted future is desirable or not. If the outlook is bright, ports can be reactive or continue business as usual and remain profitable. If the anticipated future seems challenging, a proactive approach to doing business may be necessary.

The authors of this report offer research and an objective perspective on likely future developments in the industry. The challenge the authors face is that ports are more aware of their current situation and their limitations for adaptation. For instance, they have the ability to conduct a thorough SWOT analysis and review of their own financial situation, not to mention their not-yet-public investment plans. Therefore, the recommendations are made without full knowledge of the ports' current situations and without knowledge of their anticipated future actions. The opinions of the 29 interviewees are thus highly valued and add weight to the recommendations. The interviews were conducted during 2011 and 2012 for the reports "Drivers of demand in cargo and passenger traffic between PENTA ports" and "Scenario-based traffic forecasts for routes between the PENTA in 2020". Since the ports are not able to affect all the matters mentioned below, the shipowners and the logistics companies are also mentioned in several sections.

Table 3.1. Proactive measures and recommendations.

1. Cargo traffic	
Future	• Cargo traffic increases steadily in the long run. • The speed of growth depends on many factors, including the growth of GDP, trade, and maritime transport costs. • The geographical location of a port is the most important factor in generating demand.
Effects on PENTA	• Growth will be most vigorous on the route Tallinn-Helsinki. • Traffic between Finland and Sweden will remain stable. • Routes between Estonia and Sweden have the highest growth potential. • Logistics companies will mainly choose the most affordable and suitable route at any given time.
Recommendations	• Maintain a wide range of customers and shipowners. Decentralization will also reduce the risk of a rapid decrease in total freight traffic and also support a port's growth

	potential. • Try to secure shipment reliability. Freight should be delivered within the same day and there has to be room on the vessels.
2. Unitised traffic	
Future	• Growth in speed will be faster than the increase of cargo volumes. • If freight traffic decreases, the decrease in the amount of transported units should be lighter. • Container traffic will increase the most. • RoRo traffic will remain the most used transport form between the PENTA ports.
Effects on PENTA	• Increasing unitized traffic will generate more handling of units in ports. • The increase will be strongest on the route Helsinki-Tallinn. • The amount of transported units between Naantali and Kapellskär will increase steadily.
Recommendations	• Ensure efficient internal logistics at the ports. • Work closely with environmental planning in order to better face the challenges related to connecting to the hinterland of a port.
3. Transit traffic	
Future	• Strongly dependant on the growing Russian economy and construction work being done on the Russian Baltic Sea ports. • Russia aims to reduce its reliance on neighbouring countries. • Political relations between Russia and Estonia have a significant effect on Estonia's transport volumes.
Effects on PENTA	• The increase in the consumption of goods by Russia will require alternative modes of transportation. • The number of new cars delivered to Russia is decreasing. • Special products, e.g. medicine and electronics, will still generate transit traffic via PENTA ports. • The long, narrow, and shallow channel towards Saint Petersburg will always be a bottleneck.
Recommendations	• Ports should consider new products and services to offer to Russian customers. Reputation and relations are already established.

	• Further investigation of Russia's future needs is required. Which product categories will still require external services for transportation?
4. Passenger traffic	
Future	• In general, the outlook is positive. • Destination and on-board entertainment interests can change. • The price-level in Estonia is a key factor. • The significance of tax-free shopping will be reduced if people are able to buy low-price beverages from other sources.
Effects on PENTA	• Consumers are more aware of different travel alternatives and prices than they were. • The share of commuters, especially on the route Tallinn-Helsinki, will increase. • New ferries will remain a subject of great interest.
Recommendations	• A clear separation should be made when making a categorisation between strict route passengers and commuters, and cruise passengers or passengers for leisure. • A further taken separation should be made between freight traffic and passenger traffic, especially during summertime. • Ports should work more closely with shipowners and offer complete product packages, including the cruise, hotel, land-transportation, etc. • In cooperation with shipowners, ports should use marketing and promotion in order to increase the number of customers.
5. Vessel traffic	
Future	• Timetables will remain constant, apart from seasonal changes. • Larger vessels will continue to replace smaller vessels. • The condition of a vessel will have an increasing effect on its passenger traffic.
Effects on PENTA	• The situation on routes between Sweden and Finland is currently acceptable. • The low level of frequency in cargo traffic between Estonia and Sweden will restrict its growth. • Varied departure times will be an advantage, especially for freight traffic.
Recommendations	• Ensuring a higher frequency of vessel traffic is desirable since timetable and reliability are key factors for cargo

	traffic. • Depending on the segment, passengers can value vessel speed, condition, entertainment or inexpensiveness. Time spent waiting in ports should be minimized and getting on board should be fast and effortless.
6. Port operations	
Future	• Demand for the PENTA ports will not diminish in the near future. • The demand for their services will increase. • Effective and competitive port procedures are important for interconnectivity. • The importance of connections to the hinterland will increase. • The importance of vessel frequency is already a significant factor in creating a competitive edge. This mainly applies to cargo traffic. • Spacious port areas are valued.
Effects on PENTA	• Operations at the Ports of Naantali and Kapellskär are considered to be the fastest and most reliable among the PENTA ports. • Cargo handling outside port areas is favoured due to lower costs. • Stevedoring divides opinions, due to its high costs and reliability.
Recommendations	• Focus on port efficiency and reducing time in port in order to minimize the customers' costs. • A more thorough study of the required services related to cargo traffic in future is required. • Around-the-clock operating hours should be developed as they are valued by transportation companies because trailers can then be left in ports.
7. Port economy	
Future	• The number of ports will decrease in the Baltic Sea Region. • The remaining ports will have to simultaneously compete for and divide the remaining traffic flows amongst each other.
Effects on PENTA	• The existence of PENTA ports is not threatened. • Freight will be transported via the most cost-efficient route.
Recommendations	• Secure the core activities which generate revenues but also

	seek alternative ways to make profits. • Create premises so that new routes can be developed. • Create relationships with other ports and cities in order to attract shipowners. • Port fusions can cut costs in several areas, including administration, contracts and marketing. • Increases in pricing should be moderate. • A reduction of costs on the balance sheet should be made when port operations become too restricted.
8. Logistics	
Future	• The majority of customers still perceive logistics as a necessity rather than as a factor creating competitive advantage.
Effects on PENTA	• Ports are seen only as gateways and attempts should be made to minimize the time spent in ports.
Recommendations	• An attempt should be made to change the mind-set of cargo owners. Logistics and supply chain management should be considered a strategic factor that can benefit a company's business. • Become part of the supply chain strategies of those companies which transport through the PENTA ports. • Aim to become an important logistics node rather than a simple transshipment hub by offering value in the supply chain.

2.3 Chapter conclusions

The transportation network between Finland, Sweden and Estonia is diverse and extensive. A wide variety of supply with regard to transportation by sea is a necessity, although it is simultaneously also a factor which can add value to the supply chain strategies of the companies who own the cargo. Different members in the sea transportation supply chain include manufacturers, retail stores, logistics companies, shipowners and ports.

The current situation of the PENTA ports is affected by the long development process of the traffic flows between these ports. The sizes of the ports, the structure of their traffic and their areas of specialisation are the result of market forces and consumer behaviour. The volume of cargo traffic in the PENTA ports varies a lot – between 36.6 million tonnes and 2.5 million tonnes. At the same time the share of PENTA-related traffic in these ports varies between 8% and 98% respectively. The corresponding

figures related to total passenger traffic are 10.14 million passengers and 0.18 passengers but traffic with other PENTA ports is dominant in each port.

The future of maritime traffic is affected by several factors. Current megatrends are characterised by the scarcity of energy, climate change and the control of greenhouse gas emissions and advanced technology. Other factors affecting sea transportation in the BSR are GDP growth, trade between nations, economics and politics in Russia as well as the coming into force of the sulphur directive in 2015. Due to these changes affecting the BSR, the operational environment will be challenging. It is likely that the volume of total goods traffic between the PENTA ports will rise steadily due to moderate economic growth in the BSR. The amount of trucks and trailers transported will increase by approximately 20%. The relative share of road transportation will increase most (due to the sulphur directive), but this will have no negative effect on the existing sea routes between the PENTA ports.

Due to the future challenges, ports should make plans for how to react to increasing competition, rising costs and customer demand. Regarding cargo traffic, the ports should try to maintain a wide range of shipowners operating on the different routes. The amount of transported units will increase faster than the volume of cargo, which will create challenges within ports and areas close to the ports. In order to gain more transit traffic, ports should conduct a more thorough study of future requirements for Russia. Passenger flows are currently stable or slowly increasing and each passenger segment values different aspects. From the point of view of passenger traffic, ease of access through terminals and the land connections between city centres and the ports are subjects for development. Vessel traffic is currently optimal for passengers, but freight traffic will always require more frequent departures. In terms of port operation and port economy, the focus should be on areas which create value for customers, while also securing the most significant sources of income. Cargo owners do not always see logistics or the supply chain management as a factor which creates value and this mind-set should be changed by initiating more efficient and closer cooperation with them.

3 NOISE MANAGEMENT AS A TOOL FOR DEMONSTRATING SOCIAL RESPONSIBILITY

According to the European Union's Environmental Noise Directive, END, environmental noise is an "unwanted or harmful outdoor sound created by human activities, including noise emitted by means of transport, road traffic, rail traffic, air traffic, and from sites of industrial activity" (EC 2002). An increasing focus is being put on noise and noise abatement due to the fact that noise is one of the most widespread environmental problems in Europe today. The approximate number of people exposed to noise levels hazardous to health in the European Union countries is 120 million, or 30% of the population. The situation is somewhat better in Finland and Sweden where only around 20% of the population is exposed to noise in their living environment. In Estonia, the figures are closer to the general European level, but only 13% classify noise as a problem (Estonian Review 2011; Liikonen & Leppänen 2005; Socialstyrelsen 2009, 164; WHO 20114, 1; Ympäristöministeriö 2007, 12; Ympäristöministeriö 2004, 16).

During recent decades, awareness of noise as an environmental and public health problem has grown. According to the World Health Organization (WHO) (2011, 100-102), every year at least one million healthy life years are lost in Europe due to noise. The health effects of noise include, for instance, hearing injuries, cardiovascular diseases, sleep disturbance and cognitive impairment in children. Noise is even known to cause a number of premature deaths.

This awareness has led to the development of guidelines, regulations and legislation both on international and national levels. WHO has issued guidelines for community noise (WHO 1999, 55-65) and specific night noise guidelines for Europe (WHO 2009). The European Union issued the Environmental Noise Directive in 2002 (EC 2002), which made noise mapping and action plans obligatory in bigger cities. On the national level, environmental authorities have stipulated guideline and limit values for noise, which are used for urban planning and for issuing environmental permits. Ports and other operations that are potentially hazardous to the environment are obliged to measure and map noise as part of their environmental impact assessments.

3.1 Noise as an environmental challenge for ports

Road and street traffic is by far the most important source of noise pollution, followed by rail and air traffic (Liikonen & Leppänen 2005, 39; Socialstyrelsen 2009, 165). In populated areas – and compared to the other traffic modes – maritime traffic and ports cannot be seen as a major noise polluter. Legally, port noise is classified as industrial noise, but very little is known about exposure to industrial noise in general and port noise in particular. Approximately one or two percent of the European population are exposed to industrial noise, of which port noise is only a part (Socialstyrelsen 2009, 169; WHO 2011, 65).

Nevertheless, noise is a major environmental priority for European seaports, and many ports are struggling with the issue. The European Seaports Organization, ESPO, and EcoPorts Foundation (2010, 4) ranked noise as the most prioritised environmental issue in their latest Environmental review. In the BSR, ports rank noise regulations as the second most significant environmental issue affecting port operations (Holma & Kajander 2012, 18).

In relation to the importance of ports as noise polluters, this attention to noise might seem somewhat unnecessary. However, the increase in environmental consciousness, the emergence of corporate social responsibility and the pursuit of sustainability have not left the seaport business intact. The awareness of the noise problem has reached ports through ever tightening regulations from environmental authorities, but also from the framework of their aim to pursue to better environmental standards. Regarding noise abatement, the trend is towards even stricter environmental requirements.

Noise abatement in the port environment is a technical challenge. Moreover, the legal framework to combat port noise is unclear. Even though environmental permits were required by Finnish and Swedish ports already in the 1990s, there are still legal questions that will require a legal definition supplied by the courts, especially in Sweden where the limit values for industrial noise are stricter than the limit values for traffic noise. The allocation of the cost for noise abatement is not self-evident, either. Furthermore, noise pollution caused by maritime traffic is, for the moment, only regulated in ports as part of their environmental permit, which is why the noise emanating from vessels is a concern for ports.

Another issue is that the international trend to exploit valuable waterfront land for housing and other building has influenced the operating conditions of the seaports to a great extent. Formerly, ports had the dockland areas for themselves, but now they are experiencing growing pressure from cities to turn them over to other functions. This means that residential neighbourhoods are moving closer to ports, which creates challenges to their stakeholder relations.

Traffic between the PENTA ports consists mainly of RoRo and Ropax traffic. This arrangement whereby both passengers and cargo fit into a single vessel is not optimal in all respects, but it is key to maintaining the frequent sea connections between Finland, Sweden and Estonia. Nevertheless, the arrangement makes it complicated to separate passenger and cargo traffic from each other and brings noise pollution arising from truck traffic into the city centres.

Moreover, regardless of the close relationship between urban planning and port operations in waterfront areas, the cooperation between the different authorities is currently insufficient. This can lead to problematic, unintended situations.

Finally, being a noise polluter can create bad will. Being a good neighbour is an important part of corporate social responsibility and determined noise management can be a great tool in demonstrating the social responsibility of a port.

The results of this chapter are based on the report "Noise as an environmental challenge for ports" published by TFK – TransportForsK in 2013. The empirical material of the study consists of qualitative interviews with representatives of the PENTA port authorities, city planners, acoustics consultants, inhabitants and stevedoring, shipping and construction companies in Sweden, Finland and Estonia.

3.1.1 Technical challenges

One of the reasons for noise from ports being so problematic is the sheer technical complexity of noise abatement in the port environment. The main technical issues that make it challenging are the following:

1. *The outdoor environment*. Port operations usually take place over a wide and open area, allowing noise to travel easily to neighbouring areas. Abatement measures, such as noise walls and barriers are not always possible to build due to, for instance, lack of space. Placing barriers next to water is especially difficult. The outdoor environment is also challenging for the making of acoustic measurements: it can be hard to estimate which part of the measured noise comes from the port and which part comes from other sources, such as road traffic or the city nearby. The weather, as wind, temperature and air pressure, can also greatly impact on the propagation of sound.
2. *Closeness to water*. Acoustically, there are hard and soft materials. Generally, hard materials conduct sounds, and soft materials muffle them. In port environments, hard materials such as concrete, asphalt and metal surfaces are common. Water, which ports are surrounded by, is the hardest of all materials. It easily conducts noise to the opposite shore.
3. *Several different noise sources*. Typically, port noise consists of several different noise sources such as berthed vessels, vessel-quay interface, such as ramps and hull ports, car and truck traffic, railway, working machinery and cargo handling. Moreover, one noise source can consist of different parts (power unit, exhaust pipe, tyres and beacons on a cargo handling machine). Reducing one source may not necessarily have any impact on the overall noise level (Hyrynen et al. 2009).
4. *Noise sources at different heights and scattered throughout the port area*. Noise from different positions in a port complicates the mitigation measures. The propagation of noise from sources at ground level, like tyres, is easier to muffle than those from sources higher up, such as the funnels of the vessels. Moreover, some noise sources, such as working machines and vessels are moving, which makes stationary mitigation measures inefficient.
5. *Noise including low-frequency, impulse and tonal elements.* Compared to average traffic noise, which is quite monotone in character, port noise is, due to its different sources, typically more varied. Low-frequency noise is typical of vessel engines, and muffling this requires large silencers or thick noise barriers. Impulse noise is typical for cargo handling operations. Noise with tonal elements is typically emitted from the fans of vessels and the beacons of the working machines. Common to these three types of noise is that they all are

experienced as more annoying than average noise created by road traffic (Of noise annoyance in ports, Hyrynen et al. 2009).

6. *The best available technology principle is generally not applicable.* The location and the nature of operations are of great importance to a port's noise situation. Ports located in city centres or residential areas typically experience more noise pollution than ports located further from neighbours. On the other hand, cargo ports are, measured in decibels, generally more troubled by noise than passenger ports. For instance clatter from container operations and the unloading of dry bulk cargo can generate loud impulse sounds. These factors, together with the topography and the layout of the port area, make every port unique regarding noise propagation. In environmental justice, the principle of the Best Available Technology (BAT) is widely used to benchmark the best technical standards and to prevent environmental hazards. The operators are required to use BAT whenever it is economically feasible (Länsstyrelsen i Stockholms län 2010, 6). Since the variation between ports regarding the noise question is great, all noise abatement measures have to be tailor-made to fit each port. Therefore, the BAT principle cannot be directly applied to port noise.

3.1.2 Legal and financial challenges

In Finland and Sweden, ports have been obliged to have environmental permits since the 1990s. The permit application has to include an environmental impact assessment, including noise mapping and action plans to keep the noise within the limits set. In Estonia, ports do not need an environmental permit, but environmental impact assessment, which is to be approved by the Ministry of Environment, is likewise obligatory. In Finnish and Swedish legislation, guideline values for noise are given and limit values and obligatory noise abatement measures are issued for each port separately in the environmental permit. In Estonia, there are both target and limit values for noise in the legislation (See Länsstyrelsen I Stockholms län 2010; Naturvårdsverket 2007b; Naturvårdsverket 1983/1978; Valtioneuvosto 1992; Ympäristöministeriö 2007).
In Estonia, both the Port of Tallinn and the Ministry of Environment agree that cooperation on environmental matters is currently working well. Port noise is simply not seen as a major problem and both the ports and the authorities regard the noise situation as under control. In Finland and Sweden, the situation is not as simple. Especially in Sweden there are still some unanswered questions regarding environmental permits and ports in general and the ports' responsibilities for noise abatement in particular.

Finland only has one set of guideline values for all noise, in Sweden and Estonia different values apply to traffic and industrial noise, due to historical and pragmatic reasons. The values for traffic noise are higher, whereas industrial noise is regulated in a stricter way. In Estonia this has not had any practical implications, but in Sweden building new housing in near proximity to ports or other industrial sites is, at the moment, close to impossible. The lower night time values, which are issued to prevent the disturbance of sleep, make it complicated for Swedish ports to be open 24/7. There is also a practice of exemptions from the traffic noise guidelines in densely populated

urban areas where there is a high demand for housing, but there are no corresponding practices for industrial noise. This has been noted and the Swedish government is letting the question be investigated. The practical implication is that stricter noise regulations are being applied to ports and maritime transport than to other modes of traffic (See Boverket 2008; Hedman & Möller 2011, 83-84; Prop. 2012/13:25, 79-83).

Both in Sweden and Finland, environmental permits define the legal requirements for each individual port, and the conditions are considered from case to case. This leads to the requirements for different ports varying remarkably. Regarding noise, the proximity of housing or nature protection areas is a crucial factor influencing the requirements. In some cases, it is not clear where the responsibility of the port begins. There are also unclear issues regarding car and truck traffic. In principle the responsibility of the port begins and ends at the port gates, but in some court cases ports have been held responsible for traffic moving in and out of the port and the resulting noise and emissions caused by that.

In Finnish and Swedish environmental permits, port authorities are held responsible for all environmental impacts caused by port-related operations within the ports' premises. This is regardless of whether the port authority or the port company is causing the impact, or if that impact is caused by an operator not under the direct authority of the port. As a result, a port authority is obliged to monitor the environmental performance of port operators and other port-related businesses operating on its premises. It also has to take measures to ensure that the conditions of the environmental permit are followed.

Table 3.1 Guideline values for outdoor industrial noise in residential areas in the PENTA countries ($dBL_{Aeq,}$ A-weighted equivalent levels). Sources: Naturvårdsverket 1983, 4-5; Valtioneuvosto 1992.

	Day	Evening & weekends	Night
Sweden	(07-18) 55 dB, old industries 50 dB, new industries	(18-22) 50 dB, old industries 45 dB, new industries	(22-07) 45 dB, old industries 40 dB, new industries
Finland	55 dB (07-22)	-	(22-07) 45 dB, new areas 50 dB, old areas
Estonia	60 dB (07-23)	-	45 dB (23-07)

There are efficient noise abatement techniques available, but whether they are adopted is also partly a financial question. In environmental justice, the "polluter pays" (PP) principle is widely accepted, and it is also written in the European Union Liability Directive (EC 2004; EU 2007). In the environmental permits a port, the port authority or the port company is considered to be the "polluter," regardless of whether the authority has control over the polluting activities or not. In some cases, the definition of the polluter is not clear. This is especially the case regarding noise from vessels. The dilemma of vessel noise will be discussed in chapter 3.3.1.

The PP principle is a good starting point when the allocation of noise abatement costs is discussed. In the PENTA ports, the general policy has been that each party pays for its own investments. For instance, when on-shore power supply (OPS) was installed in the ports of Stockholm and Helsinki, the ports were only responsible for the installation cost on the shore side, and the shipping companies paid for the other investments. In the port of Tallinn, the shipowner of a vessel that was producing noise pollution, funded and installed silencers on its vessel. A similar kind of arrangement was also agreed in Muuga harbour, where the noise from railway wagons was disturbing neighbouring areas. The noise walls were funded by Estonian Railways.

However, there are some unsolved questions regarding the PP principle. For example, it could be argued that ports should pay for the noise abatement in nearby dwellings. Legally, this can be the case if the noise abatement measures are not properly written into the city plan and the building permits of new housing projects near the port. However, the sound isolation of new buildings is the responsibility of the construction company not the port. This fact places great responsibility on city planners, and requires knowledge and awareness of the law regarding noise.

In addition, there are costs that are difficult to value in monetary terms because the cause and effect relationship is too complicated to measure. It is difficult to value the cost of living in an unpleasant environment or calculate the costs arising from noise disturbance. At the moment the risk of paying the hidden costs of noise is borne by inhabitants.

3.2 Noise abatement measures in ports

The list of challenges facing ports with regard to noise abatement is long, but this does not imply that noise abatement in ports is impossible. Ports have, as a matter of fact, a wide range of noise mitigation means available, varying from technical and operational to financial, juridical and cooperative.

3.2.1 Technical and operational measures

Regarding technical measures, it is generally most effective to reduce or eliminate noise directly at the source. Propagation measures which reduce the impact of noise during its path from the source to the receiver are the second alternative. Receiver methods that reduce the noise at residential dwellings are the last alternative and should only be carried out if the source and propagation measures are insufficient (NoMEPorts 2008, 43-47). The most common technical measures are the following:

1. *Noise walls and barriers.* The most visible noise abatement measures are noise barriers and walls. In the PENTA ports, the most spectacular noise wall is situated in the new Vuosaari cargo harbour in Helsinki. The concrete noise wall is one kilometre long and more than 10 meters high. It is designed to mitigate

noise propagation from the cargo handling machines to the Natura 2000 area nearby and works well for that purpose. The wall was one of the conditions the Port of Helsinki had to accept when establishing a port on that particular site. Smaller noise walls have been built even in ports of Muuga (Port of Tallinn, see ESPO 2012b, 63-64) and Pansio (Port of Turku).

2. *Traffic arrangements and speed limits* are an important part of the noise abatement work carried out by ports. In Vuosaari harbour, truck and rail traffic is directed to the port through a tunnel, partly due to noise. In the Port of Kapellskär, new traffic arrangements were used to lower the noise impact (ESPO 2012b, 69). The city of Tallinn has re-directed the traffic from the Old City harbour in order to reduce noise levels.
3. *Ramp design* is an effective way of reducing the impulse noise from the vessel-quay interface. Several PENTA ports have taken this measure. Putting rubber linings and insulations onto the ramps can practically eliminate this type of noise. For instance in Kapellskär, the noise levels were cut by up to ten to 15 decibels through the re-design of the ramps (ESPO 2012b, 68-69). Such preventive measures were also taken in Vuosaari harbour when the ramps were first built.
4. *Investing in a quieter machine fleet.* Ports can, regardless of whether they are landlord port authorities or are operating in-house stevedoring, influence the noise from the port machine fleet. Cargo handling machinery is gradually becoming quieter, especially when new electrically-driven and hybrid machinery is introduced. This change is nevertheless quite slow as the life-cycle for the machines is long. Whenever the port or the port operator invests in new machines, noise features can be taken into account in the purchasing process. This also applies to working methods in stevedoring. Significant noise reductions can be obtained by simple smoother driving and cargo handling methods. This measure is, however, not only technical, but also requires changes in the working culture and awareness of ports.
5. *Onshore Power Supply*, OPS, is an intensively debated method to reduce the environmental impact of ports. It is an effective way of reducing emissions to air and water and is also useful for reducing the noise from the vessels' auxiliary engines while they are berthed. Within the PENTA ports, OPSs have been installed for some vessels that regularly travel to Stockholm and Helsinki.
6. *Measuring the noise levels of the vessels* in regular traffic and allotting noisier vessels berths further away from housing is further a mitigation measure that can be used by bigger ports if they have several alternative berths available. This has been used by several PENTA ports. In acute situations, vessels also can be asked to turn the auxiliary engine in use away from residential areas.
7. *Port layout.* Finally, port layout itself is of great importance for noise mitigation. It is, of course, much simpler and more cost-effective to build a whole new port than to amend the layout of an existing port. For example in Vuosaari harbour a man-made hill, Porvarinmäki, was built of polluted soil. It was covered with vegetation so that the size, the location and the soft material of the hill all function as noise mitigation. Existing ports can use layout changes as noise abatement measures, too. A common measure is to build "noise-walls" of containers towards areas to be protected from noise.

3.2.2 Other ways to reduce noise

Besides the technical and operational measures, ports have a whole range of other methods available for noise abatement. Common to the most of these methods is that they are cooperative in character and are based on negotiations between the port authority and the other parts of the port community.

1. *Noise maps and models.* Noise mapping and the modelling of ports is obligatory in PENTA countries as part of the environmental impact assessment. The information can be used for monitoring the noise situation by identifying noise "hot spots" and for the planning of the technical noise abatement measures.
2. *Timetables.* The port authority confirms the timetables, which makes it possible to apply a reluctant policy for noisy vessels to stay berthed overnight or at other inconvenient times.
3. *Differentiated port fees.* Differentiated port fees that give quieter vessels discount on port fees has been suggested as a way of encouraging shipowners to invest in quieter vessels and noise abatement on board. This measure has not been applied in connection with noise reduction at any PENTA port.
4. *Negotiations with customers and other "noise polluters".* Environmental permits make the port authorities responsible for the noise from all port-related operations within the port premises, regardless of who the polluter is. This has led to a situation where the port authorities have to negotiate with, for instance, customers and operators at the terminal to encourage and engage them in noise abatement measures.
5. *Cooperation with the port city.* Car and truck traffic to and from the ports is a concern of both the ports and the port cities. In several PENTA cities, traffic arrangements have been altered to reduce the nuisance of port-related noise. In addition, several PENTA ports are in continuous dialogue with urban planners to be able to influence the use of areas close to port premises.
6. *Cooperation with other ports.* PENTA ports have established cooperation with each other and other ports regarding environmental issues. This cooperation includes information exchange, cooperation on different projects, such as PENTA, and has even taken the form of making a common statement to customers regarding vessels and noise concerns.

3.3 Specific dilemmas

Two specific dilemmas in the handling of port noise have been identified. They are intertwined and together they form the questions of port noise that are hardest to solve. Common to these dilemmas is that they are beyond the control of the port authorities alone. They are vessel noise and the relationship between port noise and urban planning. Both of them are complicated by the RoPax arrangement, which combines passengers and cargo on same vessels, making it unrealistic to move all cargo handling away from city centres.

3.3.1 Vessel noise

Vessels are the most important single noise source in the PENTA ports and the technical and acoustic features of vessel noise make it problematic. Vessels, as a rule, run their auxiliary engines to produce the electricity they need during the time they are berthed. The sound from the engines is a low-frequency, which makes it more annoying to hear. Low-frequency noise has a long wave-length, which means that muffling it requires large and space-consuming silencers on the vessel. If the noise is not muffled, standard noise walls, sound-proof windows and the like are insufficient to prevent it from penetrating nearby buildings.

Moreover, the engines are not the only noise source on a vessel. For the RoPax vessels typical of the PENTA ports, the ventilation systems of the car decks, including fans and compressors, are at least as important a noise source as the engines themselves. Also the engine rooms and hydraulics equipment need to be ventilated and car ramps are also a noise source on RoRo and RoPax vessels. On vessels with passenger traffic, the ventilation and air conditioning systems are also a significant noise source. These noise sources are located at different heights on the vessel (The acoustic characteristics of vessel noise, Hyrynen et al. 2009.)

Noise from vessels is not regulated internationally. For the International Maritime Organization, IMO, vessel noise is primarily an occupational health question, and they are also working on recommendations to protect marine fauna from noise that is emitted to water. Noise emissions to air are not on the IMO agenda at the moment, so there is no regulation in sight in the near future. Therefore, noise from maritime traffic is only regulated on the national level through the environmental permits of the ports.

In Baltic Sea Region, the forthcoming SECA (Sulphur Emission Control Area) regulations present a considerable challenge to the maritime industry. The sulphur question is the number one environmental question for shipowners at the moment, because it will have drastic effects on fuel prices and require investment in alternative fuel technologies. It is understandable that the noise question, which is not even sanctioned in any form, is not at the top of the shipowners' environmental agenda.

Noise reducing improvements on existing vessels are relatively expensive. An investment of 200,000 euros on silencers is estimated to reduce noise levels by a couple of decibels. It is an investment which will not provide direct revenues and is therefore hard to justify. The situation is different when new vessels are constructed. If the noise question is taken into account at the design stage, a good sound level can be obtained. An example of this is Viking Line's new RoPax ferry M/S Viking Grace which started to operate the Turku-Stockholm route in January 2013. Her exhaust pipes are equipped with resonators which eliminate the low-frequency noise, and her ventilation systems are also equipped with noise reducing solutions. The engines on M/S Viking Grace are mounted elastically to minimize the vibrations conducted by the hull, and this also lowers the noise levels. As noise reducing solutions increase, so will passenger and crew comfort. However, the life cycle of a vessel is up to 30 years or more, so it will take a long time before a change in the noise situation due to fleet renewal.

Onshore Power Supply

Onshore Power Supply has been intensively discussed as a noise reducing measure for berthed vessels. It is an effective way to eliminate the noise from the auxiliary engines, but does not help against other noise sources. It has other limitations as well. Firstly, it is best suited to vessels in regular traffic on steady routes. In this kind of traffic, a long-term customer relationship is created between the shipping company and the ports the vessel is using. Under these conditions it is possible to find the best technical solutions for the implementation.

Secondly, the suitability of OPS varies from case to case. The vessel has to stay in a port for a time before connecting to OPS is feasible. The time varies from case to case, but a guideline value is at least a two hour stay in port (Ramböll 2009, 29). Therefore, OPS is not suitable, for instance, for the RoPax vessels operating on most of the routes. However, vessels on the routes Stockholm-Helsinki and Stockholm-Tallinn stay berthed for several hours and for them an OPS connection is a more feasible alternative. OPS is installed on Viking Line vessels operating between Stockholm and Helsinki, and OPS is planned for Tallink Silja's vessels for when they are berthed in Stockholm (when the reconstruction of Värtahamnen is complete).

Thirdly, even though an ISO standard for OPS was issued in 2012, there are still several technical questions to be solved when OPS solutions are implemented. This complicates OPS connections for vessels that are irregular visitors, such as cruising vessels and several types of cargo vessels. Altogether, OPS should not be seen as a "quick fix" against vessel noise, it is doubtlessly a useful tool in some situations.

3.3.2 Port noise and urban planning

Building new waterfront residential areas is an international trend, which is having a great influence on the conditions of sea ports located in inner-city areas. In growing cities, available land is scarce and the political pressure to build housing is considerable. Apartments in the waterfront areas are marketed with a view to the sea, a marine atmosphere and beautiful vessels decorate the drafts of the urban planners. There are housing projects in progress in Stockholm and Helsinki and in Tallinn the exploitation of the waterfront area is also planned.

This development brings new neighbours right next door to ports. Because the limit values for noise are applied as measured by the closest dwellings, it is practically a tightening of the noise regulations of the ports.

During recent decades, the idea of safety zoning has been replaced by a "mixing" philosophy in urban planning. This means that different functions, such as living, shopping, recreation, schools, industrial operations and traffic are located in the same areas. The main idea of mixing is to create living neighbourhoods instead of suburbs without services and to avoid creating work zones which are lifeless in the evenings and weekends. Another reason for mixing is to avoid the phenomenon of urban sprawl

(Bellander 2005; Hedman & Möller 2011, 82). From the noise perspective, zoning is a simple solution, whereas mixing creates problematic situations.

One can say that cities sound like they do because the sonic has been subordinate to the visual in the Western culture for centuries. Urban planning is part of this, and planners are, as architects and landscape architects, visually educated in the first place. Although the Canadian researcher, composer and activist R. Murray Schafer launched the concept of soundscape in the 1970s, the acoustic perspective is still new and upcoming in urban planning (Hellström 2010; Schafer 1977). As noise pollution is widespread, it is becoming harder to find noise-free land on which to build new residential areas. Thus, it is not surprising that urban planners are now beginning to listen to the urban soundscape and search for solutions that create good sonic environments to live in.

The goal of urban planning is to create environments of a high quality. But – as results on the health effects of noise tell us – a good living environment is about health, not only about comfort, which is why building residential areas exposed to noise "hot spots" will always be a problematic question.

There are standard solutions for creating peaceful indoor environment and they make it possible to build in noise exposed sites, such as next to highways. The acoustic design of outdoor space is, however, still quite new and in an experimental phase. Thus, it requires a lot of creativity and innovation from the different professionals involved in the planning process. Plus, the sonic diversity of port noise makes the question even more challenging (Brown & Muhar 2004; Cerwén 2012; Forssén 2012).

A good soundscape is more than just low decibel levels. The qualitative characteristics of the sonic environment and the meaningfulness of ambient sounds have a great impact on how the soundscape is experienced (Naturvårdsverket 2007a; Nilsson 2007). The port noise debate mainly concerns noise measurement and abatement in a cost-effective manner, and little attention has been paid to the qualitative aspects of the port soundscape. This is, naturally, a reflection of the current noise regulations that only take into account quantitative measurements.

All in all, planning housing close to ports is no easy task. Negligent planning can have broad consequences and lead to undesirable deadlock situations. If the soundscape question is not taken into account at an early phase in a planning process, the risk of creating an uncontrolled cacophony of sounds is high.

The worst case scenario is an unpleasant and unhealthy living environment with unhappy inhabitants. Such disgruntled citizens will eventually complain and ports will be forced to limit their operations. The pressure to limit port opening hours and to move further away from cities will rise. There is also the risk that ports will have to pay for noise abatement measures, which are needed due to bad planning. Unsuspecting inhabitants are risking their health by investing in apartments in inappropriate areas.

RoPax traffic and noise

Another international trend influencing the conditions of seaports is to move cargo traffic to ports outside of city centres. Image-wise, cargo traffic is experienced as dirty, noisy and disturbing, whereas passenger traffic is seen to be clean and silent. The Port of Helsinki moved its pure cargo operations to Vuosaari Harbour in 2008, the Port of Tallinn has concentrated its cargo operations mainly on Muuga, and the Ports of Stockholm are planning a new cargo port in the Nynäshamn municipality.

However, the arrangement of the frequent communications between PENTA ports is based on RoPax traffic, which makes it practically impossible to separate cargo and passenger traffic as both are needed to make liner traffic profitable. The general public associates these ferries with cruises and travel between the three countries, but there is actually a vast amount of cargo transported on the very same vessels.

The possibility for the passengers to arrive direct in the city centres is a very important competitive advantage for shipowners. For cargo hauliers, this is a compromise, because the trucks tend to get stuck in the congested city traffic. For city inhabitants, the truck traffic in and out of the ports creates noise and emissions. But, as long as the traffic is part of a RoPax arrangement, these two parts are inseparable. It is important for the tourism industry to have connections direct to the city centres.

Nor is pure passenger traffic problem-free, either. Cruise vessels use ports irregularly, and discussing the noise issue with these irregular visitors is even more challenging for ports than discussing it with regular customers.

3.4 Social responsibility and sustainability in ports

The concept of corporate social responsibility (CSR) is wide and has many meanings depending on who is using it. CSR was first used to stress that enterprises should not be responsible to only shareholders, but to other stakeholders as well. Shareholder responsibility covers only the financial aspects, though profitability is a leading value in running a business. Thus, CSR was created because there was a need for ethical guidelines in business, and shareholder responsibility was not able to provide them. Depending on the line of business, CSR can include a wide variety of subjects such as employee democracy, equality between the sexes, anti-discrimination issues, community engagement, anti-corruption, human rights issues, fair trade, anti-child labour, responsible sourcing, etc. Environmental issues are nowadays an important part of CSR and the concept of corporate social and environmental responsibility is commonly used (Blowfield & Murray 2011).

Another relevant and commonly used concept is sustainability, which was originally launched in 1987 by the Brundtland Commission. The main point of the concept is to meet the needs of the people living today without compromising the needs of future generations. The concept contains three parts, environmental, economic and social sustainability, even though environmental sustainability has received most attention

(Ammenberg 2008, 30-31; 41-43). The concept of sustainability has been widely adopted both in the private and the public sector and it is used in the pursuit of more ethical codes of conduct in doing business and in governing societal development.

As the CSR concept is, above all, about self-regulation, the concept of sustainability emphasises the importance of measuring and reporting environmental performance. The reporting focuses on the financial, social and environmental aspects of an organisation. Several environmental management tools provide certification, such as ISO 14001 and EMAS, which are available for organisations wishing to make their environmental management systematic (Ammenberg 2008, 155-160; Cummings 2009, 244-247).

As the name implies, corporate social responsibility is a private-sector endeavour in the first place. The principles of creating ethical codes of conduct are, however, applicable to public-owned companies as well and social responsibility regarding, for example, public procurement is a frequently discussed topic (See Lann & Thorsell 2005). All the PENTA ports are public-owned; in Finland and Sweden, they are owned by municipalities, and the Port of Tallinn is owned by the Estonian state. This makes citizens, as taxpayers, shareholders in port companies. This also means that the port companies are more or less directly controlled by democratic institutions. Moreover, the PENTA ports have a double mandate because – as port authorities – they are obliged to ensure that laws and regulations are followed by the whole port community on the one hand, and that the port companies are driven by business principles, on the other. In Sweden and Finland, a public-owned port company is exposed to stricter public scrutiny than a private one – at least regarding the principle of public access to public records.

The European port sector has, as a part of its self-regulatory pursuit of CSR, created its own codes of practice for societal integration (ESPO 2010). Societal integration is seen as a part of the broader aims of CSR. It is defined as the "Societal integration of port-related actions by port authorities that aim to optimise relations between the port and its surrounding societal environment. To this end, it focuses on the human factor in ports, i.e. (future) employees, people living in and around port areas and the general public." The societal integration of ports has an environmental aspect and especially covers pollution problems such as noise (ibid. 11). The ESPO's code of conduct includes guidelines for gaining public support, education and labour market and port-city relationships. Regarding noise and other pollution, ports have an important task in limiting negative extremes to be able to maintain good neighbour relations (ibid. 25).

ESPO (2012a) has also self-regulatory guidelines for environmental management. The latest version of the Green Guide was published in October 2012, and it includes a section on noise management. ESPO (ibid. 7) declares five starting points for environmental management:

1. Voluntary self-regulation
2. Cooperation and the sharing of knowledge between port authorities
3. Simultaneously serving interests of the businesses and local communities while aiming at the sustainability of operations
4. Applying a systematic approach to environmental management

5. Transparency in communication regarding environmental efforts

Five types of actions for the environmental management are indicated:

1. Exemplifying
2. Enabling
3. Encouraging
4. Engaging
5. Enforcing

ESPO and EcoPorts offer their members on-line tools for beginning environmental management. The Self-Diagnosis Method, SMD, can be used for identifying environmental risks and establishing priorities for action and compliance. Port Environmental Review System, PERS, is an environmental management standard for the port sector and its implementation can be independently certified by Lloyd's Register. ESPO strongly recommends its members use these tools and aim at ISO 14001 or EMAS certification as part of their systematic environmental management (ESPO 2012a 16-19).

3.5 Noise management and being a good neighbour

Noise management is "an on-going, systematic and documented way to handle the impacts of noise on people and the environment in or around a company or a geographic area" (NoMEPorts 2008, 39). According to WHO (1999, 66-89), the goal of noise management is to maintain low noise exposures, such that human health and well-being are protected. For WHO, noise management is mainly a macro-level planning and policy-making tool, including legislation; noise exposure mapping and modelling; mitigation measures, such as noise walls; precautionary measures, such as planning land use; and building design, priority setting, and the enforcement of noise standards.

As the definition of noise management implies, it can be practiced on a macro-societal level by regional and municipal authorities all the way down to company and unit levels. There are noise management handbooks available to environmental authorities on a local level (Silence, 2008). The European port sector has its own good practice guide for noise management, which is the result of the European Union Life programme project Noise Management In European Ports (NoMEPorts, 2008), which focused on port noise mapping and noise management.

Several advantages of noise management are listed in the NoMEPorts (2008, 39) report. They include cost savings that are created through the prevention of negative environmental influence by the better planning of port functions and port development, the better control of production, the enhanced environmental quality of port surroundings, greater transparency and an improved working environment. It should be added that noise management is an essential tool for living up to the requirements demanded by environmental authorities and for being a good neighbour.

The following suggestions for noise management in ports are revised version from the guidelines given in the NoMEPorts report and applied to the current situation in the PENTA ports. The goal is that other ports can find it useful as well. The following steps should be included in the noise management:

1. *Noise measurements, mapping and modelling.* The starting point of noise management is the mapping and modelling of the noise situation within port premises and its immediate vicinity. This makes it possible to see if the port can manage to stay within the required limit values. This work is best done by external acoustics experts who have the right competence and equipment.
2. *Identifying noise sources and areas with the greatest exposure to noise*. With the help of the noise maps and models, a detailed analysis of the sources of noise can be made. Those areas with the greatest exposure to noise can be discovered.
3. *Evaluation of the impact of current noise abatement measures.* Nowadays, no port starts its noise management from scratch. With the help of the noise maps and models, the impact of current noise abatement can be estimated.
4. *Action plan.* By identifying noise sources and evaluating current abatement measures, new measures can be planned and prioritised. Action plans can include investments (such as noise walls), policy changes (such as resetting port fees), smaller changes in port layout or working methods (such as quitter driving when handling cargo) and working methods for handling difficult situations (such as allotting berths to vessels according to their noise levels).
5. *New noise abatement measures.* The implementation of action plans is the next step. This step will probably include several different time spans, depending on how comprehensive the planned actions are. Although noise management is primarily the responsibility of management, all personnel and the whole port community should be engaged in the implementation of an action plan.
6. *Complaint handling.* Even though every noise abatement measure may be taken, it is probable that the port will still receive complaints about noise. It is of great importance to have a procedure for receiving complaints. The time and the details of the noise disturbance should be documented for further analysis. The complaints should be forwarded to the highest level required and immediate action should be taken, if possible. Feedback routines should be developed so that the people complaining receive an explanation for the noise event, how it was controlled and what the port intends to do to prevent similar noise disturbances in the future. Sometimes the only thing a port can do is to give an explanation and an apology, but it is still important for the maintenance of good neighbour relations that the people complaining feel that their cause is being taken seriously by the port authority.
7. *Follow-up.* The measures taken and their impact should be continually evaluated. This should include both the impact of short-term operational measures and strategic decisions.
8. *Documentation, reporting and communicating.* The whole noise management process should be documented, reported and communicated to stakeholders and the general public. This will serve two aims: transparency and the ports obligation to reporting its environmental status to the authorities.

Even though noise management is presented in eight steps, it should be stressed that this is a continuous process with no given beginning or end. The most essential part in formulating a noise management policy is to establish a systematic, documented and transparent working method for combatting noise disturbances.

The formulating of the noise management guidelines and procedures is the concern of the port's top management, but the implementation involves all personnel and the port community. The personnel should be given the necessary authority to take measures in difficult situations, prevent unnecessary noise events and communicate with the public in an appropriate way.

The successful management of noise has the potential to be a key factor in maintaining good neighbour relations in two ways. Firstly, it helps the port to minimise noise nuisances. Secondly, a systematic complaints handling procedure is of great help when problems occur. In this way, noise management can enhance the integration of ports into their wider community and become an integral part of port CSR and an essential building block in the pursuit of sustainability.

3.6 Soundscape and the sonic environment in ports

The debate concerning port noise is about decibel levels, technical noise abatement measures and the calculation of the financial feasibility of the measures. Little attention has been paid to the qualitative aspects of the port soundscape: what the ports actually sound like. This is, of course, due to the fact that only decibels are counted when the conditions for the environmental permits or environmental impact assessments are set. Psychological, social scientific and humanistic research gives us clues as to how people experience sounds and what characteristics of a soundscape are preferred. It is known that sonic environments with "natural" sounds are preferred to "artificial" or mechanical ones, even in urban environments. The research results stress the importance of restorative environments as a refuge from stressful, noise-polluted urban environments. Typically, these restorative environments are quieter than the average urban environment and include visual and sonic elements from nature. In the urban environment, parks, fragments of forest and waterfronts are very important restorative environments for inhabitants to relax in (Ampuja 2012; Grahn 2010; Nilsson 2007).

The pioneer of soundscape studies, R. Murray Schafer (1977) describes the historical change of the soundscape with the concept pair hi-fi vs. lo-fi soundscape. The first one is the "original" and "pure" soundscape without mechanical sounds and where places have their unique sonic identities. The latter one is our current soundscape polluted by mechanical noise, where places have lost their sonic identities and which sound more or less the same everywhere.

The Finnish noise researcher Outi Ampuja (2007) describes the same change as a movement towards an artificial soundscape, which is man-made and controlled by human operations. This control of our sonic environment is, however, not a straightforward and wholly conscious process, but the result of contradictory intentions

and struggles between interests. Noise abatement measures are used to combat noise issues that require immediate attention, but an overall vision of what our society should sound like is missing. The efforts for noise abatement are also easily swept aside by the increasing amount of new machines and devices that create new forms of noise.

The Swiss researcher Pascal Amphoux (summarised in Hellström 2002, 77-80) has described three different attitudes we can have to the sonic environment. The first attitude, which is dominant, is *defensive* and consists of defending the sonic environment from acoustic pollution. Mainstream noise abatement is dictated by this quite technocratic attitude. The second attitude is *offensive* and aims at consolidating the sonic milieu, the active control of the soundscape, handling the conflicts arising from the soundscape question and engaging people in the regulation and controlling of their own sonic environment. The third attitude is *creative* and consists of composing the landscape. It is both about taking a step further towards urban sonic design and stimulating the consciousness of people regarding the sonic environment.

Against this background, we can ask the question: What kind of soundscape is desirable in the port environment? Obviously, ports have a responsibility as employers to secure a good occupational environment for their employees. They have also the responsibility to stay within the given decibel levels to secure as noise-free an environment as possible for the surrounding community. But, a good soundscape is more than just decibel levels. A silent port is impossible. But, which sounds do we wish to hear in ports and which sounds do we want to eliminate as much possible? Are there port sounds that are worth preserving? These questions remain unanswered, but might be interesting to address.

3.7 Proactive measures and recommendations

The European port sector already has come far in establishing guidelines for societal integration, environmental management in general and noise management in particular. The ESPO recommendations (ESPO 2012a; ESPO 2010) are of high relevance for the PENTA ports as well and ***the first recommendation is to follow the high standards the industry has already developed***. In addition, some complementary recommendations are made.

It is important to note that PENTA ports are diverse and have quite different operating conditions. It is understandable that bigger ports with more personnel and resources for environmental and stakeholder management have higher ambitions in this field. The smaller ones might have their hands full fulfilling the minimum requirements regarding noise abatement. Thus, the recommendations should be seen as suggestions for how the PENTA ports could develop their noise management work in the future, and they should be applied in each port as the situation allows.

It can be stated that the noise abatement requirements set by the legislation and the environmental authorities have led to a relatively high standard of noise abatement in the PENTA ports. More or less all the technical noise abatement measures taken so far have been considered financially feasible. It is likely that new requirements will be

stipulated in the future when new technical solutions are established. The next noise-related environmental measure the authorities will require is most probably a further installation of OPS. Several PENTA ports have already received stipulations to prepare themselves for its installation or to investigate its feasibility.

There are also other ways to for ports to combat noise. ***Continuous improvement***, inspired by lean production (see Womack et al 2007), is an approach worth investigating. The idea of continuous improvement is that even small things matter because they can, when combined, lead to remarkable improvements as a whole. This corresponds to the practice of attaining quieter working methods. The philosophy of continuous improvement is not just an idea for top management, but requires the involvement of the whole organisation. The idea is that there are small steps that can be taken towards incrementally improving the sonic environment in ports. This also complies with the notion of noise management as a continuous process.
As noise management implies, taking measures to reduce noise is only one part of the whole process. The most obvious improvements we can recommend are of a qualitative character. They are about approaches to the issue of noise, cooperating with stakeholders and communicating issues.

1. *Noise management approach.* A noise management approach is about being systematic and proactive to the question of noise. It also includes a proactive attitude to the soundscape question, aiming at the active control of the soundscape, instead of just protecting people from the noise caused by port activities. Controlling or creating a soundscape can be relevant, especially when ports are being (re)built.
2. *Collaboration.* The noise question in ports is so complex that it cannot be solved by port authorities alone. This is why different forms of collaboration are key to successful noise management. Collaboration should involve the whole port community, customers, suppliers, neighbouring areas, other ports and environment and urban planning authorities. Collaboration can take different forms depending on the needs of the situation. It can vary from information exchange with colleagues from other ports to measures like co-investment in noise-reducing solutions, from one-off events to strategic alliances.
3. *Communication.* Adopting a noise management approach can make a big difference to how a port is perceived by its stakeholders and the general public. That is why noise management is as much managing stakeholder relations as it about managing the noise itself. Communicating with stakeholders about noise abatement efforts is essential. Technical measures can reduce the decibel levels, but if the public does not know about them, the image of the port will not be improved. On the other hand, people are nowadays sensitive to “green wash” and this is why all the environmental statements made have to be based on real improvements. Green marketing is a great opportunity, but it has to be based on serious environmental work, it has to be communicated and the products have to be environmentally friendly (see Ammenberg 2008, 311-314).

The money and efforts invested in noise management might not always be recouped in financial terms, but they are necessary ingredients for a better environmental

performance, an improved image and good public and neighbour relations. Noise management should be seen as an opportunity rather than a threat to the port industry.

4 SAFETY, SECURITY AND ADMINISTRATIVE PROCEDURES AS OBSTACLES TO PORT OPERATIONS

Maritime transport is a complex field filled with a variety of international and national legislation and administrative, security and safety procedures. Shipping is amongst the most global of industries and it has a long tradition of international regulation in the form of international conventions. The International Maritime Organisation (IMO) together with the International Labour Organisation (ILO) are responsible for setting and administering the majority of the international conventions and regulations on maritime transport (International Maritime Organization 2013). The World Customs Organisation (WCO) and the International Standardization Organization (ISO) have actively developed maritime safety and security initiatives (Papa 2012). Over recent decades the EU has also developed its own legislation in shipping, maritime safety and the environment (Roe 2012). Legislation and regulations at national and local level also influence port operations. Often these regulations are included in port ordinance.

Despite attempts to harmonise legislation in the EU member states, there are still differences in the implementation and compliance of both the international maritime conventions and EU regulations. Often the interpretation and consolidation of these regulations, for example, regarding compliance, is done by officials at the local level (see Gulbrandsen 2011). As each country or EU member state is responsible for the implementation of EU laws and other international regulations through their own legislation, the outcomes may vary markedly. As an example, in the Baltic Sea region maritime authorities have several information systems in place to monitor their territorial and coastal waters to ensure maritime safety and security and environmental protection. These systems include vessel traffic monitoring systems (VTS, SRS, AIS), port of call reporting systems, and the information systems of border guards and customs (Aaltonen 2011). The compatibility of these systems is not self-evident. Therefore the EU has also established a central information system on vessel traffic, SafeSeaNet, which transfers data from national systems (Raitio 2007). Furthermore, private companies involved in the maritime transport chain have their own systems for transportation and warehouse management (WMS, TMS), enterprise resource planning (ERP) and for track and trace. Having these multiple systems in place for all actors involved in the maritime transport chain requires time for data entry and reporting. To improve the situation, the EU has recognised the need for the development of single window systems where the user only needs to make the data entry once, thereafter the data can be accessed and shared by multiple users.

This chapter presents the main results of two studies: “Analysis of barriers caused by administrative, security and safety procedures in Pentathlon”, and “Analysis of influence of coming requirements of security, safety and administrative procedures in Pentathlon”. The first study examined existing administrative, security and safety barriers that hinder the efficient development of maritime transport in the Central Baltic region. The second study focused on international and national legislation and analysed forthcoming requirements for safety, security and administrative procedures that come into force in the next few years. Ports and other closely related parties are required to comply with these requirements. New legislation and regulation will thus influence,

directly or indirectly, the ports' operations. The main objective was to analyse how the forthcoming regulations influence work at the PENTA ports and to work out guidelines for proactive measures with the ports located in the BSR, in general.

Port communities in the PENTA ports consist of companies whose activities are closely linked to port operations and maritime transport such as shipping companies, shipping agencies, freight forwarders, and customs. The legislative framework of a port community consists of both national and international legislation (Figure 4.1) and different legislation may influence port operations differently. Some of the barriers created by legislation have a more direct impact on cargo and passenger flows on a micro-level, whereas other rules and regulations create barriers on a macro-level, influencing the whole maritime transport system.

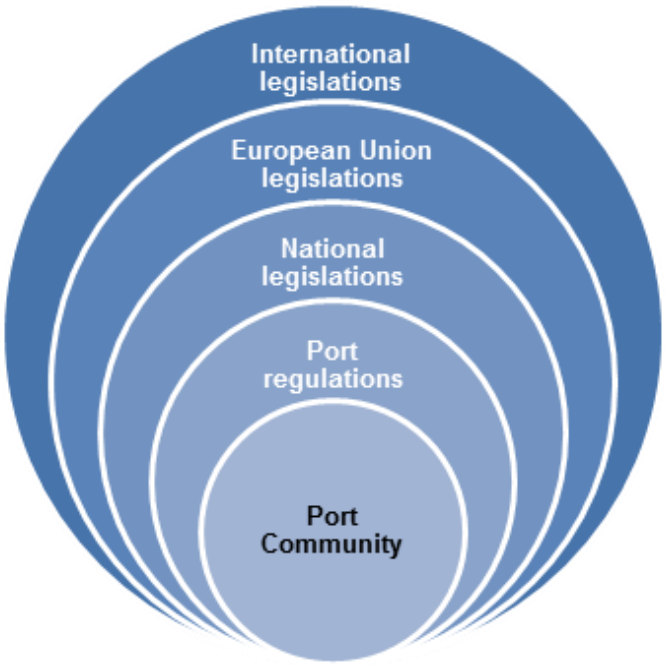

Figure 4.1. Legislative framework of the port community.

4.1 Main obstacles caused by safety, security and administrative procedures

The objective of this chapter is to analyse the operating processes of the PENTA ports and to identify the main administrative, security and safety bottlenecks that hinder the efficient development of maritime transport. The main barriers caused by administrative, security and safety procedures in Pentathlon were identified based on questionnaires and interviews with representatives of port communities at several Estonian ports.

Several factors need to be taken into account when analysing transport barriers. In general, there are notable differences between the different countries and in the local conditions at each port – and the regulatory framework in each country reflects these differences. In addition, the interpretation and implementation of both international

conventions and also EU legislation differs between different countries. At the level of ports there are marked differences between ownership structures even between neighbouring ports located in the same country. According to Pagano et al (2013) ports can be considered *pure public* when the public sector owns and operates the port; *mixed* when the public sector acts as a landowner and regulator, and all operations are performed by the private sector (the landlord model); and *pure private* when private actors own and operate the port.

The majority of European ports are variations of the mixed port ownership model, where the port is publicly owned and multiple private enterprises are tenants for the port authority and carry out their operations in the port area. This is the case also with the PENTA ports. Estonian ports follow the landlord model: they are owned by the Estonian state and private companies are responsible for port operations. In Sweden, most of the ports or port companies are owned by municipalities and private ports are a minority. In Finland, the majority of the general ports were previously owned and administered by local municipalities (Karvonen & Tikkala 2004). However, due to a recent ruling concerning EU competition law and changes in national legislation, ports are to be privatised, and municipality-owned ports will be turned into (private) limited companies (Rekimies 2011; Rönty et. al 2011), although local municipalities continue to be the main shareholders in established port companies. The merged Port of HaminaKotka was the first port in Finland to choose to become a private limited company (The port of HaminaKotka 2010; Helsingin Sanomat 2010). In addition to general ports in Finland, there are also private ports which are established and owned by private companies who conduct their own maritime transport through these ports (Karvonen & Tikkala 2004; Rönty et al 2011).

The barriers discussed in this report are mainly caused by the differences in the interpretation of international legislation on the national level, the variation in customs procedures between each country, the incompatibility of the IT systems used in maritime transport, non-compliance with regulations regarding dangerous goods, and difficulties in applying Schengen regulation concerning non-EU countries. The present barriers are discussed in the chapters 4.1.1, 4.1.2, and 4.1.5. Forthcoming regulations are discussed in chapter 4.2 and recommendations are provided in 4.3. The chapter ends with conclusions in 4.4.

4.1.1 International and national legislation

In general, shipping is well-regulated on the international level. The International Maritime Organisation (IMO) is mainly responsible for regulating shipping at the international level. According to Hinno (2011), there are about 50 IMO conventions, 30 IMO codes, 2,500 IMO circular letters, 1,700 IMO resolutions, classification rules, a number of EU conventions and directives and other documents that shipowners must constantly follow since existing documents are continually being changed and modified. Furthermore, there are approximately 150 IMO Convention changes and modifications, that shipowners must fulfil and take into account on the vessels before 2020 and 65 of them are retroactive and have to be implemented on existing ships (Hinno 2011).

A shipowner whose ships sail under two or more flags at the same time must take into account all the different national interpretations of the rules and must also be under the supervision of various authorities and classifications. Each country is free to find suitable interpretations on international maritime conventions and implement them in their national legislation on maritime issues. Economics, finance, politics, cultural background, community interests and administrative traditions influence implementation. Due to the diversity of interpretations regarding international rules and regulations, shipowners sometimes have difficulties in applying all these rules on time, especially when complying with regulations requiring major investment.

4.1.2 Customs procedures

The main bottlenecks resulting from customs procedures are caused by non-harmonized IT systems preventing the fast and effective transmission of information between countries. A customer (or hired broker company) must therefore enter the information several times into IT systems. The need for multiple data entries may also be related to poor information exchange between the ports. Although majority of the information exchange takes place electronically, paper documents are still used in some non-EU countries in Europe and in the majority of developing countries. As paper documents are time-consuming to handle and susceptible to counterfeiting, customs procedures with third countries' goods last longer and require more resources, which affects the rest of the work related to cargo transport. In addition, difficulties in the exchange of reliable and accurate information may cause serious security problems in ports.

Barriers to customs work may also be related to non-user-friendly procedures. From the customs authorities' perspective, transit traffic contains a higher level of the risk of illegal goods compared to intra-EU traffic and therefore there are additional requirements and procedures. From a system user's perspective these procedures are complex and difficult to understand. The users of customs IT systems may lack sufficient competence regarding customs procedures, which will be reflected in incorrectly completed documents. Such problems show that unnecessarily complicated procedures cause additional obstacles that hinder the efficient movement of goods. Also, it is important that customs IT systems have back-up systems in order to guarantee the declaration of goods in case of malfunction.

4.1.3 IT systems used in maritime transport

In addition to the physical flow of goods, information also needs to flow. Without IT tools it is impossible to manage the flow of goods and information efficiently (Kersten et al 2012). The IT sector is developing rapidly and these developments are affecting the maritime sector as well. Incorrectly executed and faulty documentation is often the main obstacle preventing the rapid movement of goods through ports. Electronic data exchange also helps in the fight against fraud. In addition, cargo damages and mistakes resulting from insufficient information flow between actors involved in the maritime transport chain have decreased markedly as IT systems have developed (Holma et al

2012). Even though the current IT systems are making communication with authorities a lot easier, there are still some issues which make the usage of IT systems complicated. The following points especially concern communication and data exchange with maritime authorities.

Generally, the main drawback of all IT systems is their vulnerability to malfunction. As seamless information flow is so vital for maritime transport, a breakdown in an IT system can cause considerable damage and delays. For example, if an IT-system crashes the only alternative to handling formalities with customs is to use paper copies, which can cause delays. According to the developers of the IT systems there is a back-up system in place if any breakdown occurs, but customers are still complaining that system malfunctions occur too often (Portsmuth et al 2012). This is an alarming problem for the transportation of freight as it prevents the efficient movement of goods through ports in the EU. This mainly concerns the IT systems used in customs declarations in the PENTA ports.

Another problem with the IT systems is the incompatibility of the different systems (Raitio 2007; Kersten et al 2012). The customers, for example, shipping companies, are obliged to provide several different authorities with the same reports and data. The users have to enter the same information multiple times into different systems, often manually which may cause errors, delays, thus wasting resources. As a result, port authorities often do not receive the information they need (Posti et al 2010; Posti 2012). It must also be kept in mind that the data transmitted through the IT systems is subject to human error since people enter the data transmitted in the systems (Holma et al 2012).

IT systems have evolved very rapidly and are often very complex. IT programs require higher computer skills of users, but a lack of these competencies has become a barrier to the efficient transportation of freight because workers often lack the competence to use complex IT systems. In addition, training courses may not rectify the issue. However, the complexity problem mainly concerns competency in communicating with authorities. Ideally, IT systems should be developed to match the competencies of users – not vice versa. According to Raitio (2007, 55) many port IT systems are purchased or developed solely based on the specifications given by the management, and their end-users or the people responsible for the technical management of the IT systems often have very little input regarding the specifications. Thus, creating more user-friendly systems by involving end-users in the development work should be a priority.

4.1.4 Dangerous goods

Dangerous goods that carry a high risk to human health and the environment have always received special attention in maritime transport. Regulations regarding dangerous goods are based on MARPOL (Annex III) and SOLAS conventions, which are the basis for International Maritime Dangerous Goods (IMDG code) and ISPS codes. The IMDG code gives advice on the packaging, labelling, storage, separation, handling and emergency response for each substance transported by sea (IMO 2013a). The transport of dangerous goods involves a number of administrative procedures to

prevent accidents and to ensure safe trade. In regular liner traffic, IMDG cargo is typically transported in (normal) containers or in tank containers. In principle IMDG goods are handled the same way as regular cargo at ports but with extra caution. IMDG goods must be separated from other substances and pre-notification (48 hours before arrival) is required. On the Helsinki-Tallinn route the vessel turn-around time is so short that often it is impossible to give IMDG pre-notifications on time (Raitio 2007, 25-39, 54). A cargo without required data cannot be shipped and transported and requests for information cause unnecessary delays in ports.

The majority of damage to cargo takes place when cargo is loaded and/or unloaded at ports or terminals, so the attitudes and competence of the personnel responsible for cargo handling plays a crucial role ensuring safe transportation. In general, the majority of damage to cargo is caused by human error, resulting from incompetence by cargo handling personnel, negligence and ignorance of rules and requirements (Holma et al 2012). The same reasons are usually the cause of incidents with dangerous goods. To improve cargo safety, the personnel responsible for handling dangerous goods should be trained and the special requirements for the handling of dangerous goods should be emphasised. The motivation and working attitude of the cargo handling personnel can only be influenced indirectly through education and training. According to Holma et al. (2012), active participation, feedback and immediate corrective actions by superiors can improve cargo safety the most. They also found there was a need to improve collaboration and information exchange with personnel working in other organisations.

4.1.5 Cargo traffic with non-European Union countries

Although issues with non-European Union countries do not directly influence the movement of cargo flows in liner ships between PENTA ports, they do have a large impact on the overall work of these ports. The main problem with trading non-EU goods is that the transit goods require more complicated procedures and additional documents compared to those for EU goods. The handling of these goods therefore requires more personnel resources. The laws of third countries are also often amended and usually changes are not published with adequate advance notice to other countries. The multiplicity of the required documents and the constantly changing regulations make trade with non-EU countries very complicated.

4.2 Forthcoming requirements and their impact on the PENTA ports

The daily activities and overall economic conditions of the ports are highly influenced by new regulations issued by various institutions. Both national and international legislation are frequently amended with new regulations and acts that ports are obliged to adopt. Forthcoming requirements are thus defined as different IMOs, EU law and local laws, regulations and other documentation that may significantly affect the daily activities of ports in the near future.

This chapter is based on data gained from questionnaires addressed to the PENTA ports, information from previous studies and documentation regarding forthcoming legislation. Interviews were also carried out with ports, ship agents and shipping companies on the lines Stockholm-Tallinn, Helsinki-Tallinn, stevedoring/port operator companies, freight forwarding companies, border guards, and customs. The analysis showed that several forthcoming regulations might have a strong impact on the ports. The following chapters describe regulations to be introduced on vessel emissions (sulphur, nitrogen and carbon dioxide emissions, ballast water), sanitary and veterinary regulations, Schengen regulation and competence management in port communities.

4.2.1 Sulphur oxide emission standards

Sulphur oxides (SO_x) damage the environment directly by causing acidification, and indirectly by forming particulate matter (PM), which, in turn, is harmful to human health as it causes respiratory problems (European Environment Agency 2013). In order to decrease vessel SO_x emissions, several regulations have been developed both globally and in the EU. On the international level, the MARPOL Annex VI, regulation 14 sets limits on the SO_x content of marine fuel oils. The limitations on sulphur content apply to all fuel oils, including heavy fuel oils, marine diesel oils and gas oils), regardless of their use on board, i.e. in combustion engines, boilers, gas turbines, etc. (DNV 2009). The limits are divided into two groups: outside a Sulphur Emission Control Area (SECA) and inside a SECA.

In the European Union, the first limits for sulphur content in marine fuels were introduced by the EU directive 2005/33/EC (amending directive 1999/32/EC). The new sulphur legislation was agreed by the European Parliament on the 9th of September 2012. The legislation includes rules for a general sulphur limit for fuels in European seas, which will fall from 3.5% to 0.5% by 2020. The fuel used in Europe's SECAs needs to meet the new international standard of 0.1% by 2015 (European Parliament 2012). To comply with these standards, a shipowner can use low-sulphur marine diesel oil (already available), install sulphur abatement technologies (a scrubber) on board a vessel, or use alternative fuels such as liquefied natural gas (LNG), or bio-fuels.

The marine fuel SO_x limits directly concern shipowners and ships, and indirectly the standard also affects the activities of ports. The most obvious effect is an increased fuel price (EMSA 2010). The fuel price increase is expected to raise the overall costs of maritime transports and freight rates. The Swedish Maritime Administration (2009) expects freight costs to rise between 2% and 7% and the costs for transportation by sea can be expected to rise between 25% and 40%. ISL (2010) predicts that due to SO_x requirements, ships operating in SECAs will become disproportionally more expensive. The rising costs in turn could cause a modal shift in cargo. However, regarding the modal shift, there are marked differences between the PENTA countries. Sweden and Estonia have land transport (road and rail) connections to rest of the Europe, Finnish imports and exports must always be transported by sea either to Sweden or to Estonia before they can be transported overland. To compensate for the additional costs for Finnish shipping companies, the Finnish government has reserved 30 million euros as a

compensation for shipowners, to meet the costs of additional investment, such as the installation of scrubbers, which are required to meet the emission standards (Ministry of Finance 2013, 27).

The SOx emission standards require investment by ports. The fresh-water scrubbers produce residues and, as a result, ports will have to establish reception facilities. Furthermore, in cooperation with shipowners and energy companies, ports have plans to invest in alternative fuels.

4.2.2 Nitrogen oxide emission standards

Vessels are currently producing significant quantities of NOx compared to other types of engines and combustion systems. NOx emissions cause eutrophication, which is a key issue for the Baltic Sea marine environment (Hugles 2013). NOx emissions also cause acidification and contribute to the formation of PM and ground level ozone, both resulting in negative health effects for humans (European Environment Agency 2013). At the moment the Nitrogen oxide (NO_x) emissions are regulated internationally. According to MARPOL 73/78 Annex VI, the control of NO_x is divided into different levels (Tiers I, II and III) and those limits are dependent on the engine's rated speed (DNV, 2009). Tier I represents the current NOx limit and applies to ships constructed between 2000 and 2010, Tier II to ships constructed since January 2011, and Tier III ships after the 1st of January, 2016 and corresponds to an 80% reduction from the Tier I level. Tier III applies only to Emission Control Areas and requires SCR or other advanced technology (Hugles 2013). A proposal to designate the Baltic Sea a Nitrogen Emission Control Area (NECA) has been submitted to IMO (HELCOM 2013).

In order to meet the Tier II and Tier III NO_x emission standards, shipowners are required to adopt new technologies. They may use catalytic converters (SCR), Exhaust Gas Recirculation (EGR), and alternative fuels, including Liquefied Natural Gas (LNG).

NO_x emission standards will also affect ports and their partners. According to Kalli et al. (2010), the designation of the Baltic Sea as a NECA (Nitrogen Emission Control Area) would increase the freight rates for shipping. Due to the use of Tier III NO_x emission reduction equipment (SCR) an increase of 2% to 4.6 % in freight rates for new ships, depending on vessel type, is possible and the highest rise in costs will fall on large and fast container vessels. Increased freight rates may also lead to a decrease in the quantities of goods at port, as cargo owners may decide to use other transport corridors. A decrease in the quantities of goods moved by sea and a modal shift from sea to land transport will have a negative impact on the PENTA ports and the entire maritime sector.

4.2.3 Regulation on carbon dioxide emissions

CO_2 emissions contribute to global climate change, resulting in severe global consequences. The first measures to increase the energy efficiency of the vessels and to

reduce CO_2 emissions were adopted by IMO in July 2011, when the Energy Efficiency Design Index (EEDI) became mandatory for new ships and the Ship Energy Efficiency Management Plan (SEEMP) became mandatory for all vessels. The EEDI is aimed at stimulating the continued technical development of all the components influencing the fuel efficiency of a ship and defining a minimum energy efficiency level (CO_2 emissions) per capacity mile (e.g. tonne mile) for different ship type and size segments. It has been developed for the largest and most energy-intensive segments of the world's merchant fleets: oil and gas tankers, bulk carriers, general cargo ships, refrigerated cargo carriers and container ships (IMO 2013b; IMO 2013c).

Since January 2013 all ships are required to hold a SEEMP on board at the time of their first MARPOL IAPP certificate renewal or intermediary survey. SEEMP provides the basis for a vessel owner/operator to improve the energy efficiency of all vessel operations. SEEMP also forms the basis for issuing the new mandatory International Energy Efficiency Certificate (IEEC). However, implementing SEEMP will provide a return on investment as cost savings can be achieved with improved energy efficiency (Lloyd's Register & DNV 2011; DNV 2011).

Vessel owners together with ports have several options for reducing CO_2 emissions and improving their energy efficiency. Similarly to other air emissions, the fuel a vessel uses has a significant impact on CO_2 emissions. Switching to alternative fuels, such as LNG, helps to reduce CO_2 emissions but requires investment by ports in order to make the alternative fuels available. Other operational measures include speed reduction, adjusting trim and draft, and weather routeing (DNV 2010). According to Johnson et al. (2013), shipowners will favour slow steaming, if it is enabled by increased port efficiency.

In addition, shore-side electricity systems are effective solutions for reducing CO_2 emissions from berthed ships, but these will also require major investment from the ports. Many ports do not have the necessary finances to invest and the period before any return on investment may be seen as too long. Installing shore side electricity also requires close cooperation between vessel owners and the ports as the systems in the port and onboard the ships have to be compatible.

4.2.4 Ballast water directive

The introduction of non-native species via the ballast water of vessels is one of the biggest ecological threats to coastal ecosystems globally. Increased shipping volumes are increasing the amount of foreign species arriving in the Baltic Sea. Bacteria, microbes, small invertebrates, and fertile particles (e.g. the seeds, spores, eggs, cysts or larvae) of various species are transported globally within ballast water or attached to hulls. The invaders can induce considerable changes in the structure and dynamics of marine ecosystems and produce harmful effects on the local economy (e.g. aquaculture, fisheries, maritime transport, tourism, etc.), or even pose a risk to human health (spread diseases, be toxic). Over 120 non-native aquatic species have been recorded in the Baltic Sea to date, and around 80 of these have become established (HELCOM 2013).

In 2004, the IMO adopted the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention). The HELCOM Contracting States have agreed to ratify the BWM Convention at the latest by 2013.

The BWM Convention enters into force from 2016 onwards for existing vessels, and since 2011/2012 onwards for new buildings. It is likely that this standard will require the on-board installation of BWTS, but in theory the standard may also be met with other BWM measures; e.g. improved BWE, port reception facilities (David et al. 2008). As required by IMO, BWE should be undertaken at least 200 nautical miles from the nearest land and in water depths of at least 200 metres. If this is not possible, the ballast exchange shall be conducted as far from the nearest land as possible, and in all cases at least 50nm from the nearest land and in water at least 200m in depth. In sea areas, such as the Baltic Sea where the distance from the nearest land or the depth does not meet the parameters described above, ballast water exchange may be done in Designated Ballast Water Exchange Areas. Ships trading solely in the Baltic will not be required to exchange their ballast water. However, the ships will still be required to carry a Certificate confirming compliance with the BWM Convention (DNV 2013)

When the BWM convention is in force, ships flying the flag of a country that has ratified the Ballast Water Management (BWM) Convention must have on board an International Ballast Water Management Certificate for either the D-1 standard (Exchange) or D-2 standard (Treatment). In order to get both these certificates, the Ballast Water Management Plan must be approved or examined and available on board, a ballast water record book must be available on board, and an initial survey must be conducted. Ships flying the flag of a non-ratified country that are discharging ballast water in the waters of a member country must have on board a Certificate of Compliance with the aforementioned standards (DNV 2013).

Different types of ballast water treatment technologies are already available, and the technology is also developing rapidly. Shipowners operating vessels outside the Baltic Sea that have decided to install treatment technology should carefully choose which technology best suits their vessels and meets their needs.

4.2.5 Schengen regulation concerning passengers

Border controls must be carried out according to Schengen regulations, of which the most important regulation is the Schengen Borders Code. The main problem with the Schengen Borders Code requirement is that it causes delays in border control. Since April 2012, a full passport control (both inward and outward clearance) has been made obligatory in every port during the voyage of a cruise vessel departing from a non-EU port in the Baltic Sea. The requirement has a negative impact on Baltic Sea cruise tourism as passport checks will undoubtedly discourage potential customers to take a cruise on the Baltic Sea. A declining number of visitors will diminish the income of the ports, the port cities and the local economies.

Schengen area regulations concerning the short-time visas of cruise passengers who are non-EU citizens are causing much confusion in the PENTA ports. The problem concerns regular liner traffic between EU ports and Saint Petersburg and also cruise vessels visiting both EU and non-EU ports in the Baltic Sea. St Peter Line operates traffic between Helsinki, Tallinn and Saint Petersburg. There has been misunderstanding with the visas of St Peter Line's passengers, as a person may carry either a single-entry or a multiple-entry Schengen visa. Depending on the type of visa, the regulations are different. Passengers coming from non-Schengen countries may enter EU territory with a valid Schengen visa and valid passport. When the ferry makes several consecutive calls at EU ports: non-EU citizens leaving the ferry at more than one port on the route must have a multiple-entry Schengen visa which permits multiple entries into the country. However, if a passenger has a single-entry Schengen visa then she/he may leave the ferry only in one port of call and she/he must stay on-board during the other calls on the route (St Peter Line, standard conditions of carriage 2013). Since the vessels of St. Peter Line depart from a non-Schengen port, border guards have difficulty knowing how to properly mark the visas.

4.2.6 Maritime surveillance systems and AIS

In order to make information exchange easier and faster between ships and authorities, the IMO adopted regulation 19 of SOLAS Chapter V – Carriage requirements for shipborne navigational systems and equipment, which sets out the navigational equipment to be carried on board ships, according to ship type. In 2000, IMO adopted a requirement (as part of a revised new chapter V) for all ships to carry automatic identification systems (AISs) capable of providing information about the ship to other ships and to coastal authorities automatically (IMO 2011).

The European Maritime Safety Agency (EMSA) launched a "Blue Belt" project in May 2011. The long term objective of the "Blue Belt" concept is to create a European maritime transport space without barriers, where ships are able to operate freely with the minimum of administrative formalities, irrespective of their flag. The Blue Belt project provides ship notification reports to customs authorities. The aim is to support customs by providing information about the voyages of vessels engaged in intra-EU trade. The notification reports are generated automatically by a specific module of the Community vessel monitoring system, SafeSeaNet (SSN), and delivered to the relevant customs authority two hours before the estimated arrival of a ship. The project monitored 253 vessels (the "Blue Ships"), which participated in the project on a voluntary basis (EMSA 2012).

In summary, the AIS and Blue Belt concept will make the information exchange between relevant parties easier and faster, but, in order to speed up processes at port level, changes in customs procedures have to be made.

4.2.7 Regulations regarding the transport of goods subject to special health, safety and sanitary controls

In general, a number of different acts regulate sanitary and veterinary testing on goods being transported between the EU countries and third countries. Many of the PENTA ports are involved in transit traffic between the EU and third countries. The non-EU goods face more complicated procedures, for example, regarding third country regulations for food. The multiplicities of required documents and constantly changing regulations produce many obstacles to the efficient workflow of PENTA ports.

Although all regulations concerning cargo that require sanitary and veterinary testing between EU ports is equal and the movement of cargo should be unhindered, there are still a few cases where cargo flows face obstacles. Research found one example whereby food test results from a German laboratory were not accepted by an EU authority and the country wanted to make their own tests. Such situations decrease the speed of cargo handling at ports and the overall competitiveness of the ports.

The transport of goods that require special health, safety and sanitary controls requires much paper work and time. However, all these procedures should be simpler and carried out faster. Inside the EU all laboratory tests should be standardised and the ports should have more knowledge about the tests they accept and do not. Trading with third countries is an important part of the PENTA ports' activities and, in order to maintain competitiveness, the procedures should become more standardised and the co-operation between the parties should be more effective.

4.2.8 Competence management in the port community

Growing demand for labour flexibility in port-related logistics, the growing intensity of cargo handling, the increasing use of ICT in port operations and international regulations and standards are requiring ports to think more about the competence management of employees in port communities (TransBaltic 2012). Today, ports are allowed to choose their employees according to their own standards and requirements, leading to a situation where each port has employees with different competency levels.

In order to provide an opportunity to standardise the skill levels of employees, the European Parliament and Council adopted the European Qualifications Framework (EQF) on the 23rd of April 2008. The aim of the EQF is to relate different countries' national qualifications systems to a common European reference framework. Individuals and employers will thus be able to use the EQF to better understand and compare the qualifications levels of different countries and different education and training systems (European Commission 2012).

The EQF system in ports would give employees the opportunity to raise their skill and knowledge levels. In addition, if a worker has a professional certificate, which is accepted by the other EU countries, she/he is able to search for employment freely in all EU ports.

4.3 Recommendations for ports and other involved parties

In order to adapt to the coming requirements and maintain the competitiveness of PENTA ports and the entire region, the ports and other involved parties should act immediately and choose suitable strategies. This chapter contains recommendations for the ports and involved parties with regard to all identified future requirements for security, safety and administrative procedures in Pentathlon. The recommendations are given in a tabular form. The table is divided into nine sections, each describing the topic of a forthcoming requirement. Each section of the table includes several subsections, which briefly describe the background of the subjects, bringing out the main impacts of the regulation and recommending how to adapt to the coming requirements.

Table 1. Recommendations on the forthcoming requirements for safety, security and administrative procedures in PENTA.

1. Sulphur Oxide emissions standards	
Background	• The MARPOL Annex VI regulation 14 sets limits on the SO_x content of marine fuel oils. • EU Sulphur directive (Directive 1999/32/EC amended by Directive 2005/33/EC) sets standards for the sulphur content in marine fuels. • Inside the SECA the limit of SO_x content in marine fuel is 0.10% m/m on and after 1 January 2015.
Impact	• An increased fuel price due to a sharp increase in demand for the low sulphur fuel. • Ports are required to receive scrubbers' residues, which could increase port fees. • The low availability of alternative fuels (e.g. LNG) in ports. • Operating ships in SECAs will become disproportionally more expensive. • A rise in or shift to land transport in cargoes currently transported by ship.
Recommendations	• Identify transnational corridors in the BSR where the effect of this regulation will felt most and who it will concern. • Make investments at the EU level or in those selected transnational transport corridors which are crucial in order to maintain the competitiveness of the BSR. • Get the most relevant groups of interest operating in the BSR (e.g. port authorities, cargo owners, road/rail/maritime transport operators, etc.) to work together, in order to maintain the competitiveness of the BSR. • The EU should put together financial aid packages to support the implementation of the regulation.

	• National Governments should support maritime enterprises in implementing the regulation. • Inside the EU, the requirements for SO_x emissions should be identical in order to maintain equal economic conditions regarding competition. • Ports should plan to make new investments in the infrastructure for the bunkering of new fuels and SO_x waste reception. • Ports should work together with fuel suppliers and providers to investigate the need to make investment in alternative fuel facilities. • Ports should be ready to receive scrubber residues from ships and work together with third parties to organise the handling of scrubber residues. • Shipowners should carefully choose the fuel and engine type, when purchasing new vessels. • Shipowners should carefully choose which technology to use in existing ships. • Logistics companies should calculate and plan new routes for cargo flows in order to maintain their competitiveness. • Industries, in particular shipbuilding and ship repair factories, should be ready to rebuild existing vessels. • Science and research institutions should invent new solutions in order to help the maritime community adapt to the new situation.
2. Nitrogen Oxide emissions standards	
Background	• The MARPOL 73/78 Annex VI regulation 13 sets limits on NO_x emissions from diesel engines. • The control of NO_x emissions is implemented in new ship engines.
Impact	• Shipowners are required to adopt new technologies. • The use of new technology creates additional costs for shipowners. • The designation of the Baltic Sea as a NECA, in addition to SECA would further increase the rates for shipping freight.
Recommendations	• Identify transnational corridors in the BSR where the effect of this regulation would be the greatest • All related parties should work together to maintain the competitiveness of the BSR. • Shipowners should choose between different solutions in

	order to meet the standards. • Science and research institutions should find innovative new fuels, engines and exhaust gas emission reducing systems.
3. Co-operation in the IT-field	
Background	• No specific regulation that would establish requirements for the ports' IT systems. • The EU has decided to move towards common standards, such as the maritime single window system. • A draft roadmap "Integrated Maritime Surveillance: a Common Information Sharing Environment for the European Union maritime domain".
Impact	• Customers are obliged to provide several different authorities with the same reports and data and enter the same information multiple times into different systems.
Recommendations	• The BSR transnational transport corridors should have standardised IT platforms recommended by the EU. • IT systems should be reserved to obtain higher reliability. • The forthcoming EU Maritime Common Information Sharing Environment must be easy to use. • The future EU Maritime Common Information Sharing Environment should only require minimum implementation costs for the user. • The future EU Maritime Common Information Sharing Environment should bring benefits to all participants. • IT systems should have a user-friendly and easy to learn Maritime Single Window GUI.
4. Schengen regulation	
Background	• Schengen regulations concerning the short-time visas of cruise passengers from third countries are causing misunderstandings. • Passport control has been made obligatory (inward and outward clearance) at every port during the cruise voyage from third countries.
Impact	• This regulation has led to delays in border controls. • The current situation has had a negative impact on the cruise business and clients. • It will discourage potential customers in the Baltic cruise business.
Recommendations	• The EU should change the passport control at each Schengen

	call ports and revert to the situation whereby passport controls are carried out when entering the first Schengen port and when exiting the last Schengen port. • Border guards and port authorities should work together and be given enough resources to do their job. • New technical solutions should be implemented and there should be enough manpower to increase throughput at border controls and avoid queues. • Simplify procedures or regulations in order to avoid delays at border control.
5. Competence management in a port community	
Background	• Ports are required to think more about the competence management of employees in ports communities. • In order to provide an opportunity to standardise the skill levels of employees, the European Parliament and Council have adopted the European Qualifications Framework (EQF).
Impact	• A diversity of standards in port-logistics qualifications around the BSR. • Ports have employees with different level of competencies.
Recommendations	• Authorities should make a comparative review of the existing standards in BSR ports in order to estimate the future labour force demands. • National authorities should introduce minimum standards in port logistics qualifications for all companies. • National authorities should establish professional standards that are compatible with the EQF. • National authorities should increase state funding for the development of competence management systems in ports. • Ports should consider implementing professional standards that are compatible with the EQF and competence-based training. • Ports and, their various stakeholders, including employers, unions, educational authorities, training institutions, etc. should work together to maintain and enhance the competitiveness of the BSR.
6. Ballast water directive	
Background	• The IMO adopted the International Convention for the Control and Management of Ships' Ballast Water and Sediments.

	• The BWM Convention enters into force from 2016 onwards for existing vessels and from 2011/2012 onwards for new builds. • As required by IMO, BWE should be undertaken at least 200 nautical miles from the nearest land and in water depths of at least 200 m.
Impact	• Shipowners are required to use the on-board installation of BWTS or other BWM measures. • Ports may be required to invest in new port reception facilities. • The regulation creates additional costs for shipowners (such as ballast water treatment systems, more powerful diesel generators, more powerful ballast water pumps/electric engines, re-design costs). • Differing regional approaches to BWM will complicate shipping.
Recommendations	• Close cooperation should be established with the various bodies developing BWM measures in Europe in order to assist in the harmonization of BWM requirements throughout Europe. • Consideration should be given to the participation/involvement of non-EU states that have neighbouring European seas. • All countries should implement BWM measures. • Ballast water reception should be implemented in ports. • Shipowners should find effective methods to meet the standard.
7. Carbon Dioxide emissions standards	
Background	• The first CO_2 regulations were adopted by the IMO in July 2011. • Governments and the IMO agreed a comprehensive package of technical regulations for reducing the CO_2 emissions of shipping, which entered into force in January 2013.
Impact	• Shipowners will be required to find new ways to meet the emissions standards. • Ports will need to invest in the infrastructure of onshore power supplies to maintain their competitiveness. • New investments may lead to an overall rise in maritime transport costs.
Recommendations	• Ports should consider the need of available shore-side electricity on quays in order to help shipowners adapt to CO_2

	emissions standards and maintain their competitiveness at the same time. • The legislators should give guidelines to help shipowners and other related parties adapt to the requirements. • The legislators should determine standards for shore-side electricity systems in order to avoid confusion. • The shipowners should carefully choose the new technologies in their vessels in order to meet the new standards. • Science and research institutions should invent new solutions in order to help the maritime community adapt to the new regulations.
8. Maritime surveillance systems AIS	
Background	• The IMO adopted regulation 19 of SOLAS Chapter V-Carriage requirements for shipborne navigational systems and equipment. • In 2000, the IMO adopted a requirement that all ships carry automatic identification systems (AISs) capable of providing information about the ship to other ships and to coastal authorities automatically.
Impact	• All shipowners are required to use automatic identification systems (AISs) on ships. • The Blue Belt project provides ship notification reports to customs authorities with the aim of supporting customs by providing information about the voyages of vessels engaged in intra-EU trade. • The notification reports are generated automatically by SafeSeaNet and delivered to the relevant customs authority before a ship's estimated arrival.
Recommendations	• The ship notification reports should include cargo information. • The service should include all vessels trading in the EU. • Shipowners should choose appropriate AIS transmitters on time. • Ports and other related parties should work together to achieve the objective of the concept and increase the competitiveness of the ports. • Customs should use SafeSeaNet in order to speed up processes at port level.
9. Sanitary and veterinary regulations	
Background	• A number of different acts regulate the sanitary and

	veterinary cargo trade between EU countries and third countries and inside the EU. • The ports have many trading routes between third countries and trade with third countries has been causing a number of problems for ports.
Impact	• Multiple copies of the documents create a great deal of work for the ports. • Constantly changing regulations in third countries have created obstacles and delays at the ports.
Recommendations	• The EU should harmonise sanitary and veterinary regulations in maritime cargo trade inside the EU and between EU countries and third countries. • The EU should standardise all laboratory food tests and make them recognisable between countries. • The EU and third countries should work together to produce the smooth flow of goods.

4.4 Chapter conclusions

Due to its natural shape, the Baltic Sea creates great possibilities for liner shipping and is one of the busiest seas in the world. At the same time, liner shipping in the Baltic Sea competes fiercely over cargo flows with other transport modes like road transport and rail transport. Liner shipping is essential for trade throughout the entire Baltic Sea region, and especially between Estonia, Finland and Sweden. Therefore it is vital that sea transport maintains its competitiveness and sustainability.

This chapter presented the main administrative, security and safety barriers to liner shipping between PENTA ports and analysed forthcoming requirements and their expected influence on the activities and economies of the ports. To improve the competitiveness of the ports, recommendations based on the research findings were made to the ports and other involved parties, in order to help them adapt to new situations and possible changes. Obstacles to liner shipping between the PENTA ports resulted from differences in the interpretation of international legislation and differences in national-level legislation, customs procedures, the IT systems used in maritime transport, the transportation of dangerous goods and difficulties in complying with Schengen regulation regarding goods and passenger originating from non-European countries. All these obstacles slow down port activities. Administrative, security and safety regulations create different obstacles in different ports, but the overall situation in liner shipping between the PENTA ports is similar.

Since ports have stronger international and national trade flows, it was important to analyse the influence of future international regulations, such as the international conventions set by the International Maritime Organisation (IMO) and the forthcoming legislation set by the EU. The coming standards concerning vessel emissions include

sulphur oxides, nitrogen oxide, carbon dioxide and ballast water. Also, EU regulation concerning the free movement of trade and labour, such as the Schengen regulation or competence management in port communities, will affect port operations.

All recommendations presented in this chapter are based on the research findings and freely available documents. The recommendations should help the ports and other parties adapt to the new regulations and the possible changes involved. At the same time, it will help maintain the competitiveness of the ports and the entire BSR. The recommendations are made to all the ports and other parties, since, in the maritime sector, all parties are connected to each other and it is impossible to look only at a single port without considering the rest of the port community. Full versions of both studies are to be published as part of the Estonian Maritime Academy's proceedings 2013 and are available on the WEB page www.ematak.ee.

5 CONCLUSIONS

The operational environment of the maritime business is changing. The availability and the cost of energy, the mitigation of climate change by emission control, and growing markets in Asia and South America all influence maritime transport flows. In the Baltic Sea, the development of trade between the EU and Russia is the main driving force. Ports, shipping companies, cargo owners and other actors in the maritime transport chain have many questions to consider. For example, how can the competitiveness of sea routes be ensured when the cost of fuel and other operating costs constantly rises? How can ports and other maritime actors meet forthcoming environmental regulations? How can ports be "good neighbours" in the cities where they are located? Are there ways to harmonize procedures at ports? These questions were the starting point for the PENTA project. Thus, even though this report focused on the situation in the PENTA ports, the authors aim to give guidance to all ports in the Baltic Sea region in adapting to the future while bringing attention to problems that cannot be solved by a port alone.

Co-operation is highlighted throughout this report. Collaboration is occurring and should be encouraged at many levels: regionally and locally, as well as between and within different organisations. At a regional level, all PENTA ports are dependent on each other due to the frequent connections, especially RoPax traffic, between one another. Since the PENTA ports share the same shipping lines, it is thus natural that these ports have decided to collaborate with each other to improve existing connections even more. Well-functioning sea connections and ports ensure the mobility of goods and people, and enable trade and tourism by connecting the capital regions in the three Central Baltic countries (Estonia, Finland and Sweden). Traffic flows and the socio-economic base of the Central Baltic region are thus very much intertwined. Understanding the dynamics of sea transportation and what influences cargo and passenger flows helps to target investment in the region.

An analysis of the situation of five ports in three different countries reveals that there are obstacles hindering seamless cross-border maritime connections. Ports or shipowners operating alone cannot solve the problems related to non-harmonized IT systems that prevent the fast and effective transmission of information. The interpretation of EU regulations also varies between different EU member states, which creates difficulties for cross-border activities. Shipowners that operate vessels in different countries need to take all these differences into account in their daily activities. The simplest – but not the cheapest way – is to comply with the strictest regulations. Overcoming many of the obstacles discussed in this report requires joint action on multiple levels, whether it be the EU, national authorities or across administrative borders.

The results discussed in this report show that there is still room for a closer collaboration between the ports and other maritime cluster actors regarding e.g. investment in new vessels, alternative fuels or technology. In addition, the investigation of the noise question revealed that transport and city planners are not aware of the nature of maritime transport or port operations. Closer collaboration between city planners, environmental authorities and ports can prevent a collision of interests.

Successful noise management is a process that concerns the whole port community: customers, suppliers, areas neighbouring ports, other ports and authorities responsible for environment and urban planning.

Inside port perimeters, the attitudes and competence of the personnel towards their work makes a difference. The attitudes of the cargo handling personnel plays a key role in ensuring safe and environmentally sustainable transport. Skilled employees are needed to ensure a seamless flow of information moves with the cargo and passenger flows. The contribution of every employee is also needed for successful noise management. The management of the companies have a key role to play in this work as they set strategies, provide resources, motivate employees and listen to feedback and rectify actions when necessary.

Finally, the results discussed in this report show that PENTA ports possess knowledge and expertise that can work as best practices. We encourage ports to communicate to others the work they have done regarding noise management, improved cargo and passenger safety and security and how to keep maritime transport competitive. Leadership is needed to guide the change.

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