

**MERENKULKUALAN KOULUTUS- JA TUTKIMUSKESKUKSEN JULKAISUJA
TURUN YLIOPISTON BRAHEA-KESKUS**

**PUBLICATIONS OF THE CENTRE FOR MARITIME STUDIES
BRAHEA CENTRE AT THE UNIVERSITY OF TURKU**

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2019**

THE BALTIC SEAS INTERNATIONAL MARITIME CONFERENCE – EUROPEAN MARITIME RESEARCH FROM ADRIATIC TO BALTIC

**Abstracts of the Conference
24–25 September 2019, Turku, Finland**

Tapio Karvonen (ed.)



**UNIVERSITY
OF TURKU**



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FOREWORD

This book of abstracts includes all accepted presentation abstracts submitted for the Baltic Seas International Maritime Conference European Maritime Research from Adriatic to Baltic. The event is organized by the University of Turku (Finland), Kotka Maritime Research Association (Finland) and the University of Le Havre (France).

All conference abstracts are single-blind peer reviewed. The book of abstracts belongs in the publication series A of Centre for Maritime Studies. Conference abstracts cover studies focusing on the latest innovations and developments in maritime studies, marine technology, sea borne logistics, and port operations with particular interest on environment, sustainability, and responsibility. They present a unique state-of-the-art selection of high quality research.

On the behalf of the Scientific Committee of the conference, I warmly welcome all colleagues and participants to Finland and to the city of Turku.



Prof. Tommi Inkinen
Chair of the Scientific Committee
University of Turku

TABLE OF CONTENTS

CONFERENCE AGENDA	9
Shipping Sustainability & Maritime Technology. A Balancing Act	13
Oil Spill Response in the Baltic Sea Region: Building Capacity via an International Table Top Exercise	14
SUSTAINABLE SHIPPING AND TRANSPORT	15
Simplified Environmental Assessment Model for Shipbuilding	15
Marine Scrubber Systems as Integrative Examples of Sectoral and Technological Systems of Environmental Innovation.....	17
Emissions from Marine Engines Preparing for the Upcoming Sulphur Cap Limits.....	18
GET READY - Getting Ready for the Cross-Border Challenges: Capacity Building in Sustainable Shore Use	20
MARITIME ENGINEERING AND TECHNOLOGIES	22
A Rational Quasi-Dynamic FSI Procedure for the Evaluation of Global Loads Used in the Design of Passenger Ships.....	22
Coupled Fluid-Structure Interaction in Wind-Induced Vibration of Modern Cruise Ship Deck Outfitting.....	23
Nonlinear Wave Induced Loads on a Flexible Containership in Head Seas Using Advanced Hydroelastic Methods.....	24
SEA TRANSPORTATION AT THE BALTIC SEA.....	25
Communication for Safe Icebreaking in the Baltic Sea – the Use of Verbal Communication in Ship-to-Ship Interaction	25
The Multi-Scalar Logistic Fact in the Baltic Sea Imports and Exports from 1995 to 2017	26
EfficientFlow – Efficient Flow of Goods and Passengers between Finland and Sweden.....	27
Evaluating the Use and Usability of Probabilistic Models in Oil Spill Risk Response in the Gulf of Finland, Baltic Sea	29
The Involvement of the Maritime Transport Sector in Maritime Spatial Planning	30
OPERATIONS MANAGEMENT, DIGITALIZATION AND AUTONOMOUS SHIPPING.....	31
Baltic Sea Container Ports Connectivity: AIS Data as an Efficient Tool of Analysis	31

The Analysis and Management of Safety in Autonomous Shipping: Supporting the Design of the New Autonomous Maritime Ecosystems.....	32
Improving Cyber Security Preparedness in the Maritime Logistics Industry	33
ADRIATIC AND BALTIC	35
Baltic and Adriatic Seas: Common Maritime Features for Common Port Strategies? Proposition for a Future Agenda of Research 2020–2022	35
Comparison between Shipping in the Baltic Sea Region and Adriatic Sea Using AIS Data	36
Sustainability of Small Ports: the Case of Adriatic Port of Koper	37
The Forecasting of the Seaport Performance Impact on Country’s Economics in the Baltic Sea East Coast Region	38
ACCIDENTAL SPILL RISK MANAGEMENT IN THE BALTIC SEA – FROM SCIENCE TO PRACTISE ..	39
BONUS BALTIMARI – Review, Evaluation and Future of Baltic Maritime Risk Management .	39
A Framework for Oil Spill Risk Management: Case Study from the Northern Baltic Sea	40

**The Baltic Seas International Maritime Conference, 24th - 25th September 2019,
Turku, Finland**

CONFERENCE AGENDA

DAY 1, Sept. 24

Venue: Auditorium Edu2, Educarium Building, University of Turku

- 8:00–8:30 Registration and morning coffee
- 8:30–8:45 Welcoming Address
Rector, Professor Jukka Kola, University of Turku
- 8:45–9:15 Keynote Speech: Shipping Sustainability and Maritime Technology – a Balancing Act
Associate Professor Spyros Hirdaris, Aalto University
- 9:15–12:00 CONFERENCE PAPER PRESENTATIONS

Sustainable Shipping and Transport

Simplified Environmental Assessment Model for Shipbuilding
Saara Hänninen, Saija Vatanen, Katri Behm, Jaana Hänninen & Johanna Lehtinen

Marine Scrubber Systems as Integrative Examples of Sectoral and Technological Systems of Environmental Innovation
Teemu Makkonen & Tommi Inkinen

Emissions from Marine Engines Preparing for the Upcoming Sulphur Cap Limits
Kati Lehtoranta, Päivi Aakko-Saksa, Timo Murtonen, Hannu Vesala, Topi Rönkkö, Leonidas Ntziachristos, Panu Karjalainen, Niina Kuittinen & Hilka Timonen

GET READY - Getting Ready for the Cross-Border Challenges: Capacity Building in Sustainable Shore Use
Janne Saarikoski & Vesa Tuomala

Break 15 min

Maritime Engineering and Technologies

A Rational Quasi-Dynamic FSI Procedure for the Evaluation of Global Loads Used in the Design of Passenger Ships
Nikita Dementyev, Markus Jokinen, Antti Yrjänäinen, Arun Puram
Lakshmyanarayanana & Spyros Hirdaris

Coupled Fluid-Structure Interaction in Wind-Induced Vibration of Modern Cruise Ship Deck Outfitting

Eetu Kivelä, Oliver Parmasto, Alexandra Tissari, Arun Puram Lakshmyanarayana & Spyros Hirdaris

Nonlinear Wave Induced Loads on a Flexible Containership in Head Seas Using Advanced Hydroelastic Methods

Arun Puram Lakshmyanarayana & Spyros Hirdaris

12:00–13:00 *Lunch*

13:00–14:45 CONFERENCE PAPER PRESENTATIONS

Sea Transportation in the Baltic Sea

Communication for Safe Icebreaking in the Baltic Sea – the Use of Verbal Communication in Ship-to-Ship Interaction

Magnus Boström

The Multi-Scalar Logistic Fact in the Baltic Sea Imports and Exports from 1995 to 2017

Jérôme Verny & Maxime Forrieux

EfficientFlow – Efficient Flow of Goods and Passengers between Finland and Sweden

Anders Berg, Olena de Andres Gonzalez, Heikki Koivisto, Minna Keinänen-Toivola & Magnus Sundström

Evaluating the Use and Usability of Probabilistic Models in Oil Spill Risk Response in the Gulf of Finland, Baltic Sea

Tuuli Parviainen

The Involvement of the Maritime Transport Sector in Maritime Spatial Planning
Hanna Luhtala & Anne Erkkilä-Välimäki

14:45–15:15 *Coffee break*

15:15–16:15 CONFERENCE PAPER PRESENTATIONS

Operations Management, Digitalization and Autonomous Shipping

Baltic Sea Container Ports Connectivity: AIS Data as an Efficient Tool of Analysis
Ronan Kerbiriou, Nicolas Montier & Arnaud Serry

The Analysis and Management of Safety in Autonomous Shipping: Supporting the Design of the New Autonomous Maritime Ecosystems

Osiris Valdez Banda, Spyros Hirdaris, Pentti Kujala, Janne Lahtinen, Sunil Basnet
& Meriam Chaal

Improving Cyber Security Preparedness in the Maritime Logistics Industry
Harri Pyykkö

16:15–16:45 Keynote Speech: Oil Spill Response in the Baltic Sea Region: Building Capacity
via an International Table Top Exercise
Associate Professor Dimitrios Dalaklis, World Maritime University

16:45–17:00 Closing Remarks
Professor Tommi Inkinen, University of Turku

18:30–20:00 *Welcome Reception (salad buffet) hosted by the City of Turku*
City hall, Aurakatu 2, Turku

DAY 2, Sept. 25

9:00–12:00 Visit to Meyer Turku Shipyard

12:00–13:00 *Lunch*

13:00–16:00 PARALLEL SESSIONS 1 & 2 (including coffee break)

Session 1 Adriatic and Baltic

Venue: Pub216, Publicum Building, University of Turku

Session Chair: General Delegate, Dr. Yann Alix, SEFACIL Foundation

Baltic and Adriatic Seas: Common Maritime Features for Common Port
Strategies? Proposition for a Future Agenda of Research 2020–2022
General Delegate, Dr. Yann Alix, SEFACIL Foundation

Comparison between Shipping in the Baltic Sea Region and Adriatic Sea Using
AIS Data
Associate Professor Arnaud Serry & Master of Engineering Ronan Kerbiriou,
University of Le Havre Normandie

Sustainability of Small Ports: the Case of Adriatic Port of Koper
Assistant Professor Marina Zanne & Associate Professor Elen Twrdy, University
of Ljubljana

The Forecasting of the Seaport Performance Impact on Country's Economics in
the Baltic Sea East Coast Region
Deputy Director for Academic Affairs Rima Mickiene, Lithuanian Maritime
Academy

Session 2 Accidental Spill Risk Management in the Baltic Sea - from Science to Practice

Venue: Pub209, Publicum Building, University of Turku

Session Chair: Commander Petteri Partanen, Finnish Border Guard

Oil Spill Response and Environmental Impacts

Senior Analyst Jonas Pålsson, Swedish Agency for Marine and Water Management

BONUS BALTIMARI: Review, Evaluation and Future of Baltic Maritime Risk Management

Postdoctoral Researcher Ketki Kulkarni, Aalto University

Increasing the Interest to Avoid Oil Spill Accidents by Environmental Knowledge
Professor Sakari Kuikka, University of Helsinki

A Framework for Oil Spill Risk Management: Case Study from the Northern Baltic Sea

Special Adviser Valtteri Laine, Finnish Transport and Communications Agency Traficom

Panel Discussion: Strategies for Improving Uptake from Research to Practice

KEYNOTES

Spyros Hirdaris, Aalto University, Department of Mechanical Engineering

SHIPPING SUSTAINABILITY & MARITIME TECHNOLOGY. A BALANCING ACT

With water covering more than 70% of our planet's surface, sustainable maritime transport is today recognised as one of the biggest challenges of our century. Compared with other transport modes shipping is relatively safe and clean. However, over the years to come it is imperative that our sector shall behave in a more sustainable manner especially considering the need to counterbalance safety risks arising from disruptive technology trends against fleet performance requirements and the international targets to cut anthropogenic emissions by 50% until 2050.

This keynote will review global trends that over the years to come are expected to influence the development of environmentally sustainable, yet safe waterborne transport systems. It will then discuss the important role of open innovation that will drive the future profile of shipping as one of constant evolution. Within this context, the catalytic role of lifelong education and crosscutting research for sustainable technology development and green innovation will be especially highlighted.

Key words: sustainability, shipping, ship safety and performance, technology & innovation

Dimitrios Dalaklis, World Maritime University

Jennie Larsson, World Maritime University

Jens-Uwe Schröder-Hinrichs, World Maritime University

Elif Bal Beşikçi, World Maritime University & Istanbul Technical University

OIL SPILL RESPONSE IN THE BALTIC SEA REGION: BUILDING CAPACITY VIA AN INTERNATIONAL TABLE TOP EXERCISE

Maritime transport activities are quite often associated with oil spills, which in turn impact very negatively the marine environment. Although the number of oil spills globally has a decreasing trend, their impact still remains a major concern, especially for those cities and communities near the coastline. Recent major accidents, such as the “Prestige” and “Deepwater Horizon” have highlighted the importance of training for operational personnel dealing with oil pollution, as well as the need to improve the associated response techniques.

The South Baltic Oil Spill Response project (SBOIL) is a forty (40) months (2016-2019) European Union (EU) funded initiative, which is planned as a continuation of the BioBind project. Within the scope of that project, the BioBind technology application was established, to ensure fast and effective oil spill response in any sea state condition. The goals of the SBOIL are to enhance the existing response capacities by utilising the BioBind material and to improve the protection of the marine environment in the South Baltic (SB) region from all sources of pollution -including spills from maritime accidents.

In November 2018, a Table Top Exercise (TTX) on testing a new oil spill response technique across borders was held in, Świnoujście, Poland. The TTX was conducted through an action research approach, in collaboration with project partners from Sweden, Germany and Poland as well as local, regional and national stakeholders involved in oil spill preparedness and response from the various countries around the South Baltic Sea. The purpose of the TTX was to identify operational aspects of using new and so-called “green technology” in oil spill response and provided local authorities and national incident management centres with knowledge to address areas of oil spill response improvement. With this aim, an incident exercise scenario was used to test the compatibility of International/National/Regional plans, prove command and control of cross-border incident and identify tactical decision-making processes.

The TTX included scenarios about mobilisation for an offshore response using the new BioBind material examined the topics of recovery and waste management, including alternative techniques available for oil spill response. The analysis in hand presents the set-up of the TTX, as well as results and recommendations for the future. It also aims to highlight the training needs in cross-border collaboration and increase awareness regarding oil spills and their consequences. According to the results of the TTX, the main challenge for the use of the BioBind was the difficulty involved with waste management, mainly because of the current legislation in place within the participating countries.

Keywords: oil spill response, South Baltic Sea Region, SBOIL Project, table top exercise

ABSTRACTS

SUSTAINABLE SHIPPING AND TRANSPORT

Saara Hänninen, VTT Technical Research Centre of Finland Ltd.

Saija Vatanen, VTT Technical Research Centre of Finland Ltd.

Katri Behm, VTT Technical Research Centre of Finland Ltd.

Jaana Hänninen, Meyer Turku Ltd.

Johanna Lehtinen, Piikkio Works Ltd.

Simplified Environmental Assessment Model for Shipbuilding

Research on the environmental sustainability of the maritime sector has concentrated on the operational period of ships' life cycles. Although shipbuilding has not received sufficient attention, practicing and promoting sustainable shipbuilding can represent a competitive advantage in the cruise ship market, differentiating this Finnish industry from its competitors. One of the objectives in this study was to reveal the main sources of greenhouse gas emissions in shipbuilding to direct the efforts beneficially. This study focused on collecting, combining and utilizing sustainability information of materials and manufacturing processes for creating sustainability-based value in shipbuilding. Two real-life case studies were executed, one for a shipyard and one for a ship cabin factory. An environmental sustainability model was created and a simplified environmental assessment tool for company use was developed.

Development of environmental sustainability model and simplified assessment tool

The environmental sustainability model of shipbuilding links material and manufacturing information, transportation and recyclability of materials during the entire life cycle of a product. The model is based on life cycle assessment (LCA). The most suitable indicators for the maritime sector are used to identify the hotspots in the life cycle, i.e. the most important processes creating environmental impacts.

Shipbuilding companies have a need for simplified methods and tools to assess environmental sustainability of products, production processes and services. The simplified tool uses the hotspots identified in the company-specific LCA model in such form that it can be used without previous knowledge of LCA. With this tool, the company can follow how the actions taken affect the total carbon footprint.

Case study I – shipyard production

VTT modelled the work performed within the Meyer Turku shipyard during the full 2.5-year production time of a 100 000 GT cruise ship. The analysis emphasizes energy use and the consumed main materials during the shipbuilding process, but excludes the actual ship. Transportation and the end-of-life treatment of waste or other excess materials are included in the study. The shipyard provided primary data about the shipbuilding process: energy, fuel, material, waste and scrap amounts, transportation and travelling distances. Average inventory

data was used for the production of materials, energy and fuels, and for modes of transportation.

The results from the LCA indicate that the main sources of greenhouse gas emissions at the shipyard relate to energy: electricity, heat and fuel consumption. Based on these findings, the shipyard was able to decrease its carbon footprint by almost 40% by changing electricity production to hydropower and by cutting the electricity consumption by 15% in 2017. In addition, a notable amount of material goes through the shipyard, exiting the gate as scrap or as other types of waste. Greenhouse gas emissions are emitted in the material production processes as well as in waste handling. Steel is the main material used in a cruise ship, comprising about 75% of a ship's weight; therefore it is also a significant waste material. Steel manufacturing is an energy-intensive business and excess steel is the main emissions creator in this study, even though it has a high end-of-life recycling rate (90%).

Case study II – cabin manufacturing

VTT modelled a standard cabin of a 100 000 GT cruise ship and its production processes at the Piikkio Works cabin factory. The cabin factory provided data for the energy use at the factory, raw materials of the cabin as well as transportation. Primary consumption data was complemented with average production data from the Ecoinvent database. The results from the LCA showed that a third of the greenhouse gas emissions relates to the cabin wall panels, c. 20% to immovable furniture (such as bathroom fixtures, cabinets), c. 15% to movable furniture production (beds, sofa, etc.), and c. 6% to energy consumption at the factory. The rest of the emissions come from other items, such as electrical equipment, air conditioning, and other minor items. Although the production of one cabin has a rather small impact, it has a great multiplier effect in a cruise ship as well as a large potential to lower the weight via use of alternative materials. In addition, material data is easy to apply for any interior outfitting.

This study was performed in the research project co-funded by Business Finland, Sustainability and Transparency in Shipbuilding Networks (SUSTIS). The aim of the project was to create new ways for the Finnish shipbuilding industry to take a leading role in sustainable shipbuilding.

Teemu Makkonen, University of Eastern Finland, Karelian Institute
Tommi Inkinen, University of Turku, Brahea Centre

Marine Scrubber Systems as Integrative Examples of Sectoral and Technological Systems of Environmental Innovation

Expanding literature on theoretical foundations of innovation systems has evolved to recognize the elements of sectoral and technological trajectories as applicable frameworks in the analysis environmental innovation. The importance of environmental efficiency continues to increase due the regulatory pressures, particularly, on maritime industry and shipping. In this presentation, we intertwine two key innovation concepts and apply them to systematize interlinkages of processes in environmental product innovation. We have selected marine scrubber systems as a fitting case. The presentation concentrates on the connection between innovation policy and environmental regulation. We apply technological and legal materials depicting the context of maritime scrubber systems as technological responses to more rigid environmental regulation. These materials are supported by interviews. Functional patterns of maritime scrubber systems and their implications for market potential and change are essential. We propose three windows of opportunity (technology, market and public policy) for these changes. The results underline the importance of public policy window as the driver of the development of technological innovation systems focusing on environment.

Kati Lehtoranta, VTT Technical Research Centre of Finland Ltd.
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Timo Murtonen, VTT Technical Research Centre of Finland Ltd.
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Topi Rönkkö, VTT Technical Research Centre of Finland Ltd.
Leonidas Ntziachristos, Tampere University
Panu Karjalainen, Tampere University
Niina Kuittinen, Tampere University
Hilkka Timonen, Finnish Meteorological Institute

Emissions from Marine Engines Preparing for the Upcoming Sulphur Cap Limits

The International Maritime Organization (IMO) has implemented regulations to reduce emissions from ships. These regulations consider emissions of NO_x and SO_x. Global limit for fuel sulphur content of 0.5 wt-% has been enforced starting in 2020, while in the SO_x Emission Control Areas (SECA) SO_x is already limited to 0.1 wt-%. Tight Tier III NO_x limits are applied for new builds in the NO_x ECAs. So far, there is not explicit particulate matter (PM) emission limit, globally. However, there is a growing concern towards particle emissions and limits exist for PM in some special areas like inland waterways (in Europe), where also particle number (PN) emissions are limited, starting 2020. In addition, IMO's work related to black carbon (BC) suggests that a future BC limit is probable. Finally, shipping faces major challenges related to energy efficiency and with decarbonising targets (2050).

In the present study, we investigate how the different options in fulfilling the latest SECA limitations and the upcoming global sulphur limit influence the exhaust emissions of ships. Technology options examined include lower sulphur level liquid fuels, conversion to natural gas and utilization of scrubbers. The study examines gaseous emissions, including SO_x, NO_x, CO, CO₂ and hydrocarbons, and particle emissions, including PM, PN and BC.

Experiments with low sulphur fuels i.e. with natural gas, marine gas oil (MGO) and marine diesel oil (MDO), were conducted with a marine engine in laboratory. Emission measurements were also made on board two ships during regular cruising conditions. A modern cruise ship equipped with a hybrid sulphur scrubber was first tested. The second ship was a RoPax vessel equipped with an open loop seawater-operating scrubber. Results, as expected, showed that changing high sulphur residual fuel to lower sulphur fuels resulted to lower SO_x emissions, correspondingly. This fuel change had, though, no remarkable effect on NO_x emissions. And the effect on CO₂ was minor as well. The PM, on the other hand was found to decrease, which was expected due to the lower sulphate formation. However, the present results show that there are also other parts of the PM (like organic and elemental carbon) influenced by the fuel change. Using natural gas in dual fuel mode in the engine, resulted to reduction of SO_x emission by almost 100% and NO_x emissions approximately by 70% compared to liquid marine gas oil. In addition, significantly lower PM, PN and elemental carbon was achieved when utilizing NG as a fuel. However, a simultaneously observed methane slip should be taken into account when evaluating the climatic impacts of NG fuelled engines. The on board measurements indicated scrubbers to be very effective in SO_x reduction. In addition PM was found to decrease in the

scrubbers. However, further research is needed to solve influence of a scrubber on particle number and size, especially when discussing the health impact of ship emissions with the growing trend in utilization of scrubbers.

Janne Saarikoski, Kotka Maritime Research Association (Merikotka)
Vesa Tuomala, South-Eastern Finland University of Applied Sciences (Xamk)

GET READY - Getting Ready for the Cross-Border Challenges: Capacity Building in Sustainable Shore Use

The coastal zone of the Eastern Gulf of Finland is recognized as a valuable natural object that is highly sensitive to anthropogenic impacts and effects of global warming. On Russian and Finnish sides, a network of ports has been established to ensure the exchange of goods, raw materials and intellectual information between the eastern and western Baltic countries, which is a prerequisite for sustainable development of the whole Baltic region. At the same time, this development is accompanied by an increase of uncertainty levels in the coastal zone. The appearance or enlargement of new objects (such as ports) in the coastal technosphere leads to increasing pressure on the natural environment.

A Russian-Finnish project GET READY (1.5.2019-30.4.2022) aims to increase the readiness of the cross-border region to the existing and expected challenges by introducing examples of the best practices on both sides and applying innovative solutions in the field of sustainable shore use. The way to achieve this objective is capacity building in the field of environmental and professional education and training of students, professionals, stakeholders and decision makers in the region. This is done by developing and implementing educational and training programs for a wide range of audience, using the accumulated experience and the best practices in the region of Russian and Finnish ports.

The United Nations has defined the Sustainable Development Goals for the year 2030. The most important goals for the GET READY project are climate change, digitalization of the marine ecosystem, economic development and education. One goal of the GET READY project is to increase cooperation and environmental awareness between ports, shipping companies and authorities. Communication also aims to increase the awareness and readiness of individuals to mitigate the effects of climate change.

Cooperation in the project is done with Russian and Finnish academic, scientific and business partners. The project is coordinated and managed by Eco-Express-Service LLC, and other Russian partners are the Russian State Hydrological Institute and the St. Petersburg State University. The Finnish partners are connected to Kotka Maritime Research Centre (KMRC). KMRC combines the expertise of four leading Finnish universities and research institutes in the fields of maritime transport and logistics, maritime safety and the environmental effects of maritime activities. Two KMRC members – South-Eastern Finland University of Applied Sciences (XAMK) and University of Turku, Centre for Maritime Studies (CMS) – are GET READY project partners. Also, the third Finnish partner, the Finnish Environment Institute (SYKE) is a member of Kotka Maritime Research Association, the background organization of KMRC.

XAMK and Kotka Maritime Research Association have joint activities in the project. First, a workshop on how to execute digitalization as an environmental decision-making tool will be

organized. A group of experts will be gathered to a workshop to discuss the execution of digitalization and environmental management tools as guidelines for decision-making.

The regional and local forces will challenge harbours over the world – these forces are digitalization, climate change, mobility, society's combining and migration. Digitalization has a major role for gathering accurate data to making knowledge-based decisions.

Data can be collected from various sources, for example from company's existing databases or open data sources. Ports can gather own multiple and environmental data streams through interfaces and sensor technology. Integrating these data streams with ICT systems, ports can create new tools for decision-making and more effective operating methods. These tools could also be used for forecasting regulative demands in the future. Digital situational awareness systems can include port area, nature, traffic and infrastructure. Digitalization with these systems may facilitate rapid and accurate response to anomalies.

Also, training content and two short training courses concerning digitalization as a tool in environmental management will be organized. One course will take place in Russia, one in Finland. The focus of the training days is in digitalization. Digitalization is as a phenomenon and megatrend – a possibility of combining data and digital technologies. Courses will include case examples of digital ports and ports' challenges in managing environmental issues, and examples of opening and using port-related data.

The port stakeholders are strongly guided also by national and international legislation. XAMK is examining both current and future legislation and regulations, and searching the best practices for the development of digitalization of port owners and operators, as well as shipping companies.

MARITIME ENGINEERING AND TECHNOLOGIES

Nikita Dementyev, Elomatic Oy, Marine Consultancy and LCS

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Spyros Hirdaris, Aalto University, Department of Mechanical Engineering

A Rational Quasi-Dynamic FSI Procedure for the Evaluation of Global Loads Used in the Design of Passenger Ships

The current boom in cruise and passenger ship markets has led to corresponding increase in the size of ships and their structural complexity. The optimization of capital expenditure costs remains a critical part in the design and construction of such ships. Additionally, to ensure sufficient functional safety margins the designers have at their disposal state-of-the-art tools and rational design methods for design and structural strength assessment especially for ships with general particulars and structural features that are not covered by the existing empirical Classification Rules.

This paper presents a rational quasi-dynamic response approach for the evaluation of global loads of passenger vessels. The method couples wave-induced hydrodynamic pressures with a rigid hull idealization performed with ANSYS AQWA and ANSYS SpaceClaim. The CAD structural model of a typical cruise ship was produced using CADMATIC Hull with basic design accuracy. Furthermore, model was transferred to ANSYS SpaceClaim to obtain an FEA model comprising of beam and shell elements representing the primary and secondary parts of the structure. NAPA software was used for evaluating the still water bending moment. Consequently, the 3D diffraction/radiation panel code ANSYS AQWA was used to define the wave pressures acting on the hull and loads were mapped on the hull surface and transferred to the ANSYS FEM solver for hydro-structure coupling. As a result, still water and wave bending moments are received as well as ship's response.

Comparisons against Class Society Rule wave bending moment and shear forces amidships demonstrates that the direct evaluation of the wave bending moment and shear force envelopes along the hull girder may be a preferred approach in terms of assuring global structural strength and optimizing total steel weight.

Keywords: passenger ships, global loads, quasi-dynamic response, FEA, ship hydrodynamics

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Coupled Fluid-Structure Interaction in Wind-Induced Vibration of Modern Cruise Ship Deck Outfitting

Recent market trends in the cruise industry aim to provide traditionally land-based attractions on cruise liners. This leads to the integration of special architectural features, such as water parks and amusement rides, in way of the cruise ships' upper decks. Deck amusements are lightweight structures that comprise of slender beams to reduce the added weight on top decks. To ensure safety it is critical to understand the influence of wind loading introduced by Vortex-Induced Vibrations (VIVs) on their dynamic structural response.

This paper presents some preliminary results on the differences between one- and two-way coupled Fluid-Structure Interaction (FSI) analyses in the context of ship deck outfitting subjected to VIVs. Accordingly, a mega deck amusement structure is idealised as an aluminum portal frame, subject to a constant head wind. Transient one- and two-way coupled FSI simulations, based on Reynolds-Averaged Navier-Stokes (RANS) fluid dynamics model and linear elastic 3D FEA, are conducted using the commercial CFD software STAR-CCM+. Results are assessed and compared against quasi-static and quasi-dynamic beam element idealisations solved by NX Nastran.

The investigation carried out reveals that vortex shedding remains at the original shedding frequency in the one-way coupled solutions. However, the two-way coupled simulation demonstrates a clear lock-in of the vortex shedding to the portal frame's natural frequency. Consequently, the dynamic loading experienced by the portal frame is significantly increased and the structure experiences resonant vibration when full two-way FSI coupling is considered. Neither the one-way coupled nor the quasi-dynamic analysis are able to capture these effects.

Keywords: fluid-structure Interaction, vortex-induced vibration, FEA, CFD

Arun Puram Lakshmyanarayana, Aalto University, Department of Mechanical Engineering
Spyros Hirdaris, Aalto University, Department of Mechanical Engineering

Nonlinear Wave Induced Loads on a Flexible Containership in Head Seas Using Advanced Hydroelastic Methods

The ever-increasing size of ships and offshore structures has resulted in 'softer' structures that require hydroelastic effects to be taken into account when predicting wave-induced motions and loads. Numerical hydroelastic investigations use, by and large, linear to partially/fully nonlinear potential flow solvers. The success/accuracy of such numerical methods in capturing violent free surface flows and strong nonlinear effects is a function of their inherent assumptions and, accordingly, has shown modest improvements in the ensuing predictions. RANS solvers, on the other hand, can fully take into account the nonlinearities associated with free surface flows, as well as viscous effects if and when required, making them more realistic. Presently, wave-induced load calculations with RANS solvers predominantly use one-way coupling, where the ship is considered rigid in the fluid solver and the RANS fluid loads are mapped onto a FE model (or used to evaluate generalised forces which provide the generalised excitation to a multi-dof system of linear equations in terms of principal coordinates), thus omitting fluid-structure interactions which can be significant. A strong or two-way coupling between RANS/CFD and FEA codes has to be implemented to accurately model the hydroelastic behaviour of a vessel floating/travelling in a seaway.

This paper presents a two-way coupling between CFD (STARCCM+) and FEA (ABAQUS) codes to model the 3-D dynamic behaviour of a flexible S-175 containership advancing with a forward speed in regular head waves. A 3-D beam FE model is used to model the structure of the containership and 3-D modelling for the fluid-structure interaction. The Star-CCM+ mesh is build up on the past experience with refined meshing in regions such as free surface, wake and ship boundary, resulting in approximately 3.5M cells. The main emphasis is on the prediction of linear and non-linear wave loads. The effects of the nonlinearities are expressed in terms of the higher order harmonics and the asymmetry in sagging and hogging loads. The predicted wave bending moments, for a range of wave frequencies and positions along the hull, are compared with a number of experimental measurements and other published numerical predictions and demonstrate the capability of the two-way coupled CFD/FEA method in predicting the nonlinear effects even in relatively severe wave conditions. The influence of mesh refinement and structural damping on predicted responses is investigated for some operational conditions.

Keywords: hydroelasticity; fluid-structure interaction, coupling, RANS/CFD; wave-induced loads; nonlinearity, springing

SEA TRANSPORTATION AT THE BALTIC SEA

Magnus Boström, Kalmar Maritime Academy

Communication for Safe Icebreaking in the Baltic Sea – the Use of Verbal Communication in Ship-to-Ship Interaction

Shipping through icy waters, from a global perspective, is generally limited to very few vessels. The reason for this is simply that few parts of the earth have sub-zero temperatures. Consequently, a majority of the world's nautical officers have no or very limited experience in ice navigation. Consequently, a vessel directed to a new area of operation with possible ice might face a challenging situation where navigation through ice is necessary, something that the crew is not properly prepared for. A number of factors with the potential to improve the safety during icebreaker operations have been distinguished. These factors include technical aspects, training and experience, and formal requirements for vessels in ice. Furthermore, a Work Domain Analysis has been performed, to model the work carried out by icebreaker officers. The results indicate that in the dynamic environment posed by ice and harsh weather, the icebreaker crew relies on own previous experience of ice navigation, but is also dependent on interaction and communication with the crew on board the assisted vessel.

In light of the studies described above, the final part of this project will focus on verbal communication, communication that is characterized by varying prerequisites. In one end, the icebreaker crew is well trained, highly skilled and masters English. In the other end, there are vessels receiving assistance where the crew has barely seen ice before, has limited experience of Baltic Sea conditions in general, and icebreaker operations in particular, and has limited English skills. All nautical officers are mandated to command English at a certain level, set out in IMO's Standard Marine Communication Phrases. This standard prescribes, among other things, the use of closed-loop communication, a three-step communication technique to avoid misunderstandings. By studying recorded VHF communication, it became clear that closed-loop communication was not used to its full extent during icebreaker operations. Specifically, the final step where the sender acknowledges the receiver's interpretation of the message was rarely observed. Based on research from other areas, closed-loop communication has potential to improve interpersonal communication. In addition to increasing safety during operations where there is little room for error, better multi-cultural communication has the potential to make shipping in ice-covered waters more economically sustainable by reducing delays and environmental risks.

Jérôme Verny, MOBIS – NEOMA Business School
Maxime Forrieux, HIGHFI – HF-LAB

The Multi-Scalar Logistic Fact in the Baltic Sea Imports and Exports from 1995 to 2017

MOBIS uses a big database, which contains all exchanges of goods in the world from 1995 to 2017, of which the source data is the Observatory of Economic Complexity (O.E.C.). We can quantify the flows in the level of countries in the Baltic Sea. This study defines the Baltic Sea by nine territories: Denmark (deu), Estonia (est), Finland with the Åland Islands (fin), Germany (deu), Latvia (lva), Lithuania (ltu), Poland (pol), Russia (rus), and Sweden (swe).

In a first approach, in order to prepare this abstract, the O.E.C. database can obtain the exchanges between one territory and the eight other territories. The Baltic Sea is semi-closed sea. Therefore, in this case, we can make a hypothesis: these commodities were shipped within this sea. Only Russia has other possibilities with the Black Sea, the Pacific Ocean, or the Arctic Ocean. The result of our extraction shows that the integration of the Baltic States and Poland in the E.U. boosted the value goods, which traded, but the market crisis in 2008 has stopped this increase. So as to understand this observation, we must switch territorial scale.

In a second approach, we will compare the Baltic exchanges with the E.U. and all territories throughout the globe. The purpose is demonstrated that the raise is shifted in another larger scale. In this case, the Baltic exchanges are too limited and very overloaded in relation to the global economic. If it is not the solution, the Baltic exchanges decline, and we will search to understand why. To find the good solution, we will have to calculate a long extraction from the O.E.C. database with a computer. This will be explained by us in the Maritime Conference.

In a third approach, we will study in more detail the exchanges at the level of the commodities. We will allow to compare the three territorial scales. It is very difficult to estimate the results, but the other people of the Maritime Conference will be able to visualize the economic situation in the Baltic Sea during twenty-three years in terms of the exchanges of goods.

Anders Berg, Swedish Maritime Administration (SMA)
Olena de Andres Gonzalez, Satakunta University of Applied Sciences (SAMK)
Heikki Koivisto, Satakunta University of Applied Sciences (SAMK)
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EfficientFlow – Efficient Flow of Goods and Passengers between Finland and Sweden

The Baltic Sea Region is extremely dependent of efficient transport solutions all year around. Currently there is a need to improve the quality of maritime transport between Finland and Sweden in order to optimize the flow of goods in the corridor both by sea to better integrate sea transport with road and rail. The possibilities for just-in-time arrivals and departures, especially in the maritime part of the corridor should be improved.

Today, not all the actors in ports are communicating with each other in a systematic way, nor do they take advantage of digital tools for information exchange. The coordination of port calls are carried out manually. This increases the risk for misunderstandings, results in longer lead times, inefficiencies and an unnecessary administrative burden. The overall objective of the EfficientFlow project is to improve the flow of goods and passengers through the two corridors of Gävle-Rauma and Stockholm-Turku by implementation of Sea Traffic Management (STM). The STM is a concept for optimizing the processes, interaction between stakeholders and exchange of information within port areas as well as between ports. The aim of the project is to implement STM in these corridors, to validate the concept and start to utilize the benefits for the maritime community. The project will make the transport flow in the corridors more efficient by improved processes and new digital solutions. The project will deliver improved processes, business models and ICT tools for enhanced information exchanged between port actors, between ports, between port and hinterland operators and between ports and ships. Increased accuracy of information by digitization, waiting times and lead times will be reduced in all parts of the logistic chain. Flow optimization and route optimization will facilitate just-in-time arrivals and just-in-time operations, which contribute to reduced consumption of bunker, reduced emissions (CO₂), provides energy efficient and safety transport system and socio-economic benefits to the corridors. The implementation of STM in the ports of Gävle and Rauma will be the first operationalization of the concept in the Baltic Sea region. The results of the project will be carefully analysed and evaluated, widely disseminated and can serve as best practices examples for other corridors and ports in the Central Baltic area and beyond. The functional specification and the materials prepared for the public procurement of the ICT systems will be shared openly with other ports or actors. The results of the implementation will be used for marketing of the ports, the transport corridor and the Central Baltic region as a “best practice”. The results will also be shared with universities and research institutes to be used in other research. Lessons learnt will be transferred to education and capacity-building.

By improved information exchange between the actors of the two corridors in the Central Baltic area will contribute to higher efficiency and timesaving in both corridors, reduced transport

time, higher transport predictability and improved sustainability and transport quality. The invested resources will contribute to long-lasting real hands-on changes in the functioning of the corridors and to improve the digital maturity of the two corridors. And, it will also contribute to achieve the transport policy goals of both the EU, the involved countries and the Central Baltic region at large. The project is expected to produce a time saving of 7%. The project will be implemented in a partnership with the Swedish Maritime Administration as Lead Partner and with the VTS Finland, Port of Gävle, Port of Rauma and SAMK as partners. Terminals and operators (maritime and hinterland) together with other actors in the maritime transport ecosystem will benefit from the project results and will participate in and contribute to the project work.

Tuuli Parviainen, University of Helsinki, Faculty of Biological and Environmental Sciences

Evaluating the Use and Usability of Probabilistic Models in Oil Spill Risk Response in the Gulf of Finland, Baltic Sea

Oil spill models are valuable tools in response planning and risk management. Assessing and managing oil spill risks is, however, challenging as oil spill risks can be considered as systemic and complex risks characterized by high levels of uncertainty. Our on-going study examines the use of probabilistic (Bayesian) risk models in oil spill response planning and decision-making in the Gulf of Finland, Baltic Sea. Bayesian networks (BNs, also known as belief networks) are increasingly used to simulate uncertain and complex systems. In the Baltic Sea, BNs have also been applied research on the ecological impacts of potential oil spills as well as to risk management and evaluating risk control options.

However, the use and utility of the models in a decision-making context has not been analysed before. With the use of in-depth interviews, this study examines 1) how have the different Bayesian risk models been produced, 2) what the strengths and weaknesses of the models, and 3) how the models can support effective response planning and decision-making. The study methods include in-depth interviews: the first set of interviews include the modellers, the second set the managers, and finally, national and international decision-makers themselves will be interviewed. The preliminary results indicate that the probabilistic models have multiple benefits in assessing complex environmental risks but so far the use of the models outside the academia has been limited. We suggest that participatory modelling, where stakeholders are included in the different steps of the model development phase, can facilitate discussion about uncertainties as well as contribute to collective learning.

Hanna Luhtala, University of Turku, Faculty of Science and Engineering
Anne Erkkilä-Välimäki, University of Turku, Brahea Centre

The Involvement of the Maritime Transport Sector in Maritime Spatial Planning

Seas are directly and indirectly utilised and affected by multiple human activities. While the intensity of traditional sea uses has increased at the same time as new uses are emerging, the seas are becoming more crowded and the marine environment is facing increasing pressures and impacts caused by these activities. This poses a serious threat to coastal seas, where most of the marine production takes place. During the last decades, Maritime Spatial Planning (MSP) processes has been developed to respond to the growing need for managing and coordinating human activities at seas. MSP is a public process of allocating human activities in marine areas in a sustainable way. Within the EU, the member states are obligated to produce plans for their sea areas by March 2021. However, the practices for implementing national MSP processes may differ. In the Baltic Sea region, some countries already have binding plans and others are still in the beginning in the MSP processes.

One of the key elements in all MSP processes is the involvement and integration of stakeholders. The EU directive on MSP stipulates to consult stakeholders, authorities, and the public in the preparation of maritime spatial plans. As part of the BONUS BASMATI research project, the Pan-Baltic case study investigated this stakeholder integration process and especially the business sector involvement in MSP. The study focused on the maritime transport sector, which according to previous research efforts have been stated to lack interest in participation in cross-border MSP discussions. The two-phase case study aimed to evaluate the perceptions of feasibility and motivation of the business sectors to participate in MSP. First, the planning authorities and experts of MSP were questioned regarding their perceptions and expectations on the business involvement in MSP. During the second phase, business representatives were asked about their views and attitudes in relation to MSP and stakeholder involvement.

In general, while all interested stakeholders are offered a possibility to participate, the level of interest towards the planning process varies among the stakeholder groups. In some of the Baltic Sea countries, the maritime transport sector has been more actively involved in the planning process than in the others. However, due to the nature of the sector, it was commonly recognised as one of the core sectors when discussing cross-border collaboration among neighbouring countries. On the whole, it was seen beneficial to involve business support organisations and representative unions instead of integrating companies and other individual actors directly. Many planners had an impression that companies are not aware of MSP processes or they do not find it as an important tool for themselves. The lack of awareness or importance might be reflected also on the low overall interest to answer the questionnaire aimed at the maritime transport sector representatives in umbrella organisations and companies.

OPERATIONS MANAGEMENT, DIGITALIZATION AND AUTONOMOUS SHIPPING

Ronan Kerbiriou, University of Le Havre Normandie

Nicolas Montier, University of Le Havre Normandie

Arnaud Serry, University of Le Havre Normandie

Baltic Sea Container Ports Connectivity: AIS Data as an Efficient Tool of Analysis

In the recent years, ocean container shipping has resulted in a specific network connecting the main ports together and these ports to smaller ones by regular feeder services which tend to use smaller size containerships. Today, Baltic maritime transport is again on the rise. In 2016, BSR ports handled 881.3 million tons, establishing the best ever result for the region. BSR traffic growth is particularly important in the field of containerization: container traffic is likewise rapidly growing, from 1.2 Million TEU in 1990 to 9.9 in 2017. Integration of Gdansk in the network of Maersk routes for new big container ships shows also the ability of Baltic ports to participate and compete in the global networking.

This presentation aims to present a survey of the current situation of container shipping in the Baltic Sea, which, as a basin for ocean-going container ships, is partly restricted by physical prerequisites, small markets and limited hinterlands that by consequences also reduce attractiveness of ports. It focuses on the integration of the ports in the containerization networks. This situation is emphasized by the organisation of regular lines, mainly connected to northern European ports and especially to the German ones. The research was carried out using mainly Automatic Identification Data (AIS). The data acquired from AIS systems constitute a new means of information, which allows to perform multiscale, diachronic and synchronic analyses. A desktop study as well as a statistical analysis, which has required the construction of a database, are also used. By focusing on vessels, shipping companies and ports, this communication considers the process of containerization in the Baltic Sea region with a special attention on ports' network.

Keywords: Baltic Sea, port, container, network, maritime transport, AIS

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The Analysis and Management of Safety in Autonomous Shipping: Supporting the Design of the New Autonomous Maritime Ecosystems

Over the last five years research work in the area of autonomous shipping accelerated. The recent development and implementation of technologies fostered the idea that autonomous ships can be soon a reality. Over the coming decade autonomous technologies will be developed, tested and operated in a fast changing and ultimately disruptive environment. To date developments have not questioned or presented the demands of innovation and educational infrastructure that should be in place to support the management of risks and safety in the design and implementation of these technologies. With the later in mind, this paper will outline the elements of developing safety management systems for the life cycle assurance of autonomous shipping assets. To achieve this it will introduce a novel approach to analyze risks and to support the modelling of autonomous maritime ecosystems with focus in managing safety of remote and autonomous pilotage operations.

Harri Pyykkö, VTT Technical Research Centre of Finland Ltd., Transport & Logistics

Improving Cyber Security Preparedness in the Maritime Logistics Industry

This paper reflects the level of preparedness regarding cyber security related factors in maritime logistics industry inspired by the empirical research from the Baltic Sea Region (ref. Ahokas & Laakso 2017) which highlighted the inadequacy of cyber threat preparedness and regulation in the maritime industry. Ahokas (2019) also indicated that there is a lack of research regarding maritime cyber security, ever more factors and actors need to be studied and understood at a more general level in order to raise the awareness of cyber security even further. Presently the level of digitalization is rapidly increasing combined with new emerging technologies i.e. Artificial Intelligence, Internet of Things, Blockchain etc. that are being utilized with accelerating speed in the maritime logistics among others. The future trend in the maritime logistics indicates that all the resources are connected with each other in order to form integrated autonomous operating systems based on IT-platforms, which are providing substantial benefits for operations and supply chain optimization. Due to the significant transportation volumes involved in the maritime logistics, it has a vital role linking the global economies together. This fact makes the ICT systems of maritime logistics especially attractive target for malicious cyber attacks. A possible cyber attack on critical infrastructure such as ports can cause tremendous damages in various ways. (Kalogeraki et. al. 2018)

There are already various practical examples like NotPetya cyber attack against world's largest container carrier Maersk in July 2017. The maritime sector has had to face the fact that cybersecurity needs to be included in physical security system and organizational strategies (Shah 2004; Skrlec et al. 2014). As the reliance on ICT systems grows, aspects of physical security need to be updated to a sufficient level in terms of the security of ICT and physical-related components of the maritime sector (Fitton et al. 2014). The growing digitalization of the naval systems increases the attack surface of maritime Information systems (Hebrard et al. 2017) and it is important that all the actors in the maritime logistics will perform risk assessments at regularly to identify the likelihood of cyber attacks that might pose a threat in the future. (Polatidis et. al. 2018)

The maritime sector is vulnerable especially in terms of operational risks such as accidents, failures of equipment or mishandling of dangerous cargo, labour strikes, and security breaches (Kouwenhoven et al. 2016). Various types of risk in maritime ICT system have been recognized from deliberate attacks to unintended but damaging malware and simple technical failures. These failures and attacks can compromise vital safety, security and environmental functions or may even jeopardize the functionality of global trade. (Lytle III & Thomas 2015). Simply by disrupting or shutting down the ICT systems within a port, cyber attackers could endanger emergency responses and cause different types of accidents. (Kouwenhoven et al. 2016; Polemi 2018). For example, cyber attackers may gain access to commandeer a ship, close a port or its terminal and access delicate information. Even the smallest cyberattacks towards maritime industry can lead to business losses of millions of dollars. (Caponi et al. 2014). Maritime supply

chains include globally scattered, interconnected set of organizations that include several entities. (Polatidis et. al. 2018)

“SAFETY FIRST” reads in block letters in several places in the physical infrastructure related to maritime logistics industry indicating the high importance of preventing any type of accidents. The safety related issues have always played a major role in the maritime sector as even a minor accident might have serious effects to the people and environment due to the large cargo volumes involved which are often including hazardous materials in addition to the potential financial losses. However, there are several indicators that there is a general need among maritime sector to extend the traditional safety view to focus more closely also towards improving the cyber security matters and increasing the cyber awareness by training the entire personnel. Whoever has access to the ICT-systems has to be aware how to prevent cyber threats in their daily work. In terms of improving research on this subject, it appears that the majority of the cybersecurity research have been done with the focus of technical approach while there is a lack of more specific cross-functional research on cyber security in framework of maritime logistics especially. “Cyber security is not only a technological, but also a strategic and political issue which affects every physical or legal entity and which everyone for their part is responsible for.” (EU/NIS Directive, p1, art. 3.)

ADRIATIC AND BALTIC

Yann Alix, SEFACIL Foundation

Baltic and Adriatic Seas: Common Maritime Features for Common Port Strategies? Proposition for a Future Agenda of Research 2020–2022

Liner shipping keeps following operational concentration strategies that directly affect competitive relationships between port authorities. Two opposing outcomes impact peripheral territories such as the Baltic and Adriatic Seas. On the one hand, an unavoidable feederisation is being set up as is the case in the Mediterranean from super regional hub ports that benefit from attractive geostrategic positions (Port Said, Algeciras, Tangier Med, Piraeus, etc.). On the other hand, a strategic decentralization that turns some Baltic and Adriatic ports into connecting points as close as possible to hinterland, thus reducing costs and transit-time through integrated qualitative multimodal services.

As part of its applied research studies, the SEFACIL Foundation supports forward-looking and strategic thinking to better understand what would be next in the fields of ports, maritime and logistics. With the BALTIC SEAS initiative launched in 2017, the SEFACIL Foundation has built an open network of academic experts and professional to explore forthcoming strategic organisations of the Baltic Sea. As part of this contribution, the SEFACIL Foundation proposes to open the network to the stakeholders of the Adriatic Sea, which has many geographical, economic and strategic similarities with the Baltic Sea. The objective of this contribution is to suggest avenues and discuss about how to consolidate a future agenda of research that would be fed by applied research team from both the Baltic Sea and the Adriatic Sea until at least 2022.

Arnaud Serry, University of Le Havre Normandie
Ronan Kerbiriou, University of Le Havre Normandie

Comparison between Shipping in the Baltic Sea Region and Adriatic Sea Using AIS Data

World trade has transformed in the twenty years such that container traffic flows are oriented towards more parts of the European continent. The European container port system is not a homogeneous set of ports; instead, it consists of several big ports (e.g., Rotterdam, Hamburg, Algeciras...) and a large number of medium and small ports.

The main focus of the paper is on the container network in the Baltic Sea Region and in the Adriatic Sea studying contemporary changes and organization, as well as explaining the main driving forces of this situation. The geographical configurations of the region naturally place both seas away from major global shipping lines. This situation is accentuated by the organization of maritime regular lines, centred in Northern European ports or Mediterranean transshipment hubs. So, the idea is to compare flows and networks in these two European peripheral seas having welcomed a remarkable growth during the last decade.

The Baltic Sea is a transport corridor between Eastern and Western Europe. Over the last decade maritime transport in the Baltic Sea area has changed significantly. The disintegration of the Soviet Union forced Russia to start developing its own Baltic ports and terminals and to find new routes to export its oil and gas.

The Adriatic Sea looks also like a transport corridor between Southern and Central Europe. Adriatic ports, Rijeka, Koper, Trieste, Venice and Ravenna..., are small ports. Each of these ports have different development plans but in varying degrees' common hinterlands and costumers.

Marina Zanne, University of Ljubljana, Faculty of Maritime Studies and Transport
Elen Twrdy, University of Ljubljana, Faculty of Maritime Studies and Transport

Sustainability of Small Ports: the Case of Adriatic Port of Koper

The importance of ports in supply chains as well as in national and regional economies is unquestionable. However, at the same time, ports produce various negative externalities, like noise, dust, deteriorated air and water quality, road congestion etc. This is particularly problematical when ports are located in close proximity to the cities as it poses extra pressure on the port management to put social and environmental aspects of port operations high on the list of their priorities and in such way assure sustainable port-city relation. Such ports highly depend on local community support.

The authors address the port-city relationship issues on the case of the Port of Koper, the only Slovenian international cargo port. Port of Koper is a young and relatively small port, located in a strategic position in northern Adriatic. After the introduction of the port and its development plans, the authors focus on the public perception of the port and proceed with the measures taken by the port management to improve port's environmental performance and achieve higher social acceptance of port activities. The objective of the paper is to investigate what small ports located close to the residential and business areas can do to improve the port-city relation without jeopardizing their economic performance.

Keywords: port-city relation, sustainable port, small port, case study, evaluation methods

Rima Mickiene, Lithuanian Maritime Academy

The Forecasting of the Seaport Performance Impact on Country's Economics in the Baltic Sea East Coast Region

The paper scientific relevance is based on analysis of scientific publications of A. Smith, M. Porter and P. Krugman retrospective attitude and modern tendencies of J.E. Stiglitz, A. Sen, J.P. Fitoussi and K. Schwab. The nowadays ports surrounding is characterized by main changing trends: international trade policy and global geopolitical initiatives; development of the containerisation; port specialisation vs. port universalisation; priority of the safety of the national economics especially in developing countries, the vulnerability of the maritime sector due to the strong link with the hinterland, port's impact on the performance of the city and the country or the global supply chain; port's negative impact on ecological and social environment and sustainable development, impact of the 4IR etc.

The port performance is influenced by the port's position in the global supply chain, country's level of international trade and by the structure and development of the transport infrastructure. Forecasting of the impact of the port performance on Estonia, Latvia and Lithuania economics is based on evaluation of the nowadays port surrounding and analysis of the links of the port performance and country's macro economical, business environment and social indicators. To achieve the positive impact of the port performance on the country's economics, port conception must be adapting to modern market conditions: from maximizing productivity to the creation of the added value for stakeholders and society. According to the empirical findings, it can be stated that the economics of Estonia and Latvia are more influenced by the port connection with hinterland and on land transport performance, while Lithuanian economics are mostly related on port performance. Estimating the impact of port activity, the formation of cargo niches is observed in Estonia and Latvia: ro-ro cargoes in Estonia, containers in Latvia become characteristic. While forecasting the development of the Lithuanian economy in relation to port activity, it can be concluded that is necessary to develop the port infrastructure, however, the country needs to find the cargo market exclusivity and reduce dependence on cargo flow from Belarus.

Keywords: port performance, country's economic advantages

ACCIDENTAL SPILL RISK MANAGEMENT IN THE BALTIC SEA – FROM SCIENCE TO PRACTISE

Ketki Kulkarni, Aalto University

BONUS BALTIMARI – Review, Evaluation and Future of Baltic Maritime Risk Management

The BONUS BALTIMARI project sets out to review the current state-of-the-art in risk analysis and decision support, focusing on the Baltic Sea area. We target the areas of a) Maritime transportation systems (MTS) and b) Offshore energy production systems (OEPS). In collaboration with various stakeholders, we aim to identify priorities for future research in risk management.

Maritime transportation is essential for ensuring continued prosperity and economic growth of countries around the Baltic Sea. Development of offshore energy production is an important activity to decrease the dependency on carbon-based energy sources, which is particularly important given the negatives effects of climate change. These activities also involve high risks to human lives, ecosystem health, and economic sustainability. Illegal operational or accidental discharge of oil or other noxious liquid substances in the sea can have serious negative ecological, economic and social consequences. With the advent of fast technological change in maritime industries such as autonomous shipping becoming an increasingly realistic prospect, new risks continuously emerge. Improving society's ability to manage risks emerging from the MTS and from the OEPS is important for ensuring sustainable ecosystems and for ensuring economic prosperity.

We present results from comprehensive reviews of academic and non-academic work covering the areas of maritime safety and risk assessment. We identify patterns, trends, and gaps, to serve as a guide for future research and development. Focus is on the contributions originating from the Baltic Sea area, contextualized in a scientometric analysis of the global research activities in this application domain. We aim to understand how the activities in the Baltic Sea area link to the global research community.

In this presentation, we use the insights from the reviews and analyses to chart out potential future directions for research efforts in maritime safety and risk assessment. We welcome inputs from the various stakeholders about their views on important topics for the future.

Valtteri Laine, Finnish Transport and Communications Agency Traficom

A Framework for Oil Spill Risk Management: Case Study from the Northern Baltic Sea

Effective risk management for pollution preparedness and response (PPR) is an essential aspect of ensuring a clean marine environment and other important interests of states, such as tourism and fishery. Therefore, it is necessary to continuously ensure that such preparedness measures are in place at both national and regional levels, which facilitates timely and coordinated response to limit the adverse consequences of oil pollution accidents.

In the European Union, national authorities are responsible for managing the risks of accidental oil spills in their jurisdictions in accordance with the national Oil Spill Contingency Plan. To reinforce these activities over larger sea areas, regional cooperation agreements have been established between the EU member states and other coastal states, e.g. the Helsinki Convention (HELCOM) in the Baltic Sea, and the Bonn Agreement in the North Sea. In the context of these agreements, several regional risk assessment initiatives have been implemented, representing important milestones in the establishment of risk-informed PPR decision-making processes for the European sea areas.

Despite the current progress in this field, these joint European risk assessments have faced wide criticism for the following reasons:

- lack of harmonized terminology and common approaches;
- lack of transparency in the methodological basis of the risk assessment tools;
- lack of comparability of risk assessment results in spatial and temporal terms;
- high implementation costs; and
- challenges in implementing the risk assessment results, especially when authorities of different countries are involved.

This presentation introduces a risk management framework for PPR, the aim of which is to tackle the criticism. It was developed during the EU OpenRisk project 2017-2018 in cooperation with the European PPR authorities and other stakeholders. The work was carried out primarily through a series of workshops around Europe.

This risk management framework for PPR includes two components. The first consists of four ISO 31000:2018 standard based risk management processes, which focus on different decision-making contexts in this field. The second is a set of 20 open-source risk assessment tools, the purpose of which is to provide risk-related knowledge for supporting the decision-making in these different contexts.

Furthermore, the presentation shows the results of the Baltic Sea case study, which is a practical demonstration of the PPR risk management framework. The study was conducted jointly by the OpenRisk partners, the Norwegian Coastal Administration and DNV-GL through a series of test runs and analysis of results.

The case study focused on two of the PPR risk management processes noted earlier. In order to carry out all steps of the associated risk assessment processes, a total of 10 different risk assessment tools were used, including new applications developed within the OpenRisk project. In geographical terms, the scope of this case study was limited to the northern Baltic Sea areas, due to limited access to necessary data.

For more information about the PPR risk management framework and the Baltic Sea case study, see HELCOM Publications (<http://www.helcom.fi/helcom-at-work/publications>)



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