KOTKA MARITIME RESEARCH CENTRE

ANNUAL REPORT 2021

CONTENT

1. FOREWORD

ANNA KIISKI

It might be fair to say that 2021 has been a kind of intermediate year for us. The impact of COVID19 on our operations has been significant, but at the same time it has highlighted the need to reconsider the future operation of the research centre. Our eyes has been strongly turned to the future, but at the same time we are focused on re-examining the basics.

During the year, significant changes have taken place in the universities involved. At the end of 2021, new five-year contracts were signed for the two professorships, with the Aalto University and the University of Turku. Further, the composition of university research groups has largely changed. This is of course part of the normal development of research groups, but have major effect to cooperation in general. In addition, the professorship of the University of Turku was shifted to the Department of Geography and Geology. This will strengthen the possibilities for academic research cooperation among our member universities.

However, the most significant change during the year has been that the association had a possibility to hire a research director on a permanent basis. This position has a significant role to play in motivating university researchers to engage in genuine collaboration. Interdisciplinary collaboration does not arise by itself but requires resource allocation at the interface. This solution has now been made.

So, the year I call an intermediate year has been used well. The research centre's internal structures and operational resources are in order. From the beginning of 2022, we will start to prepare a new strategy, so we have a good starting point to create a common new direction for the future. In this world situation, reflection on a new direction is more than necessary.

Executive Director
Anna Kiiski

2. KOTKA MARITIME RESEARCH CENTRE IN BRIEF

Kotka Maritime Research Centre specialises in the interdisciplinary approach to maritime transport and logistics, taking into account a wide range of safety, environmental and economic aspects. The common vision of the research community operating under the Centre, representing leading Finnish universities and research institutes, is to promote the overall sustainable development of the maritime sector and research in the field in Finland. Research is problem-driven and solution oriented, seeking for scientifically validated answers and feasible solutions to topical socio-environmental questions and problems.

Good societal decision-making needs to be based on scientifically verified information. Kotka Maritime Research Centre's expertise is built upon research carried out at the University of Helsinki, Aalto University, University of Turku, and South-Eastern Finland University of Applied Sciences. Kotka Maritime Research Association acts as an umbrella organisation that coordinates, manages, and supports the universities' joint research projects. At the moment, our core researcher network consists of 28 experts.

Beyond academia, the research centre works closely with a great number of experts in related fields. Our partners include such organisations as the Finnish Environment Institute, Natural Resources Institute Finland, Finnish Transport and Communications Agency, Finnish Transport Infrastructure Agency, and Metsähallitus, as well as the development company Cursor Ltd, Etelä-Kymenlaakso Vocational College, and Kotka Maretarium.

Merikotka was founded in 2005 at the initiative of the city of Kotka. Because seafaring is a key industry in the city, they wanted to know more about the risks related to maritime transport and how to control them. For this purpose, the research centre was created to make use of the knowledge held by various universities and to produce high-quality research on maritime transportation, marine traffic safety and their impacts on marine environment.

3. GREETINGS FROM THE NEW RESEARCH DIRECTOR

PHOTO:VEIKKO SOMERPURO

ANNUKKA LEHIKOINEN

In the spring of 2021, I had the honor of being elected the new Research Director of the KMRC. Since officially starting the post in April, in addition to networking and project planning activities, my focus was on the launching and engaging the revised KMRC core research network.

As a guiding light in my work, I have used the external research reviews [1] of the KMRC for years 2015-2018. The main message of the evaluators was that the community is formed by a group of highly skilled people, capable for innovating and doing high-quality research. However, the criticism considered the faint demonstration of the actual interdisciplinarity and cross-university collaboration, when it comes to the outputs of the network, as well as the unclear role of the KMRC behind the results. The researchers were not seen to have identified themselves as KMRC researchers either.

Having worked in various multi-disciplinary research communities, I have learned that the true interdisciplinarity, potentially leading to cross-disciplinary outcomes, requires concrete joint targets and tasks. An important part of my work is to help the KMRC community to find productive and motivating ways to conduct interdisciplinary work that will lead to cross-disciplinary outputs and competence, and to facilitate this collaboration. Naturally, helping the network to plan projects and acquire funding that enables continuous collaboration is a vital part of this work.

The academic world has traditionally been strongly divided to disciplinary silos with isolated research cultures, theories, and methods, leading to differentiated terminologies. All this hinders interdisci-

[1] Mäkinen, Anita 2019: External Review - Kotka Maritime Research Centre Kotka Maritime Research Centre (KMRC) in 2014-2018. Kotka Maritime Research Centre publications 1/2019. ISBN 978-952-69646-0-7

Schröder-Hinrichs, Jens-Uwe 2020: External Review, part II - Kotka Maritime Research Centre. Kotka Maritime Research Centre publications 2/2020. ISBN 978-952-69646-2-1

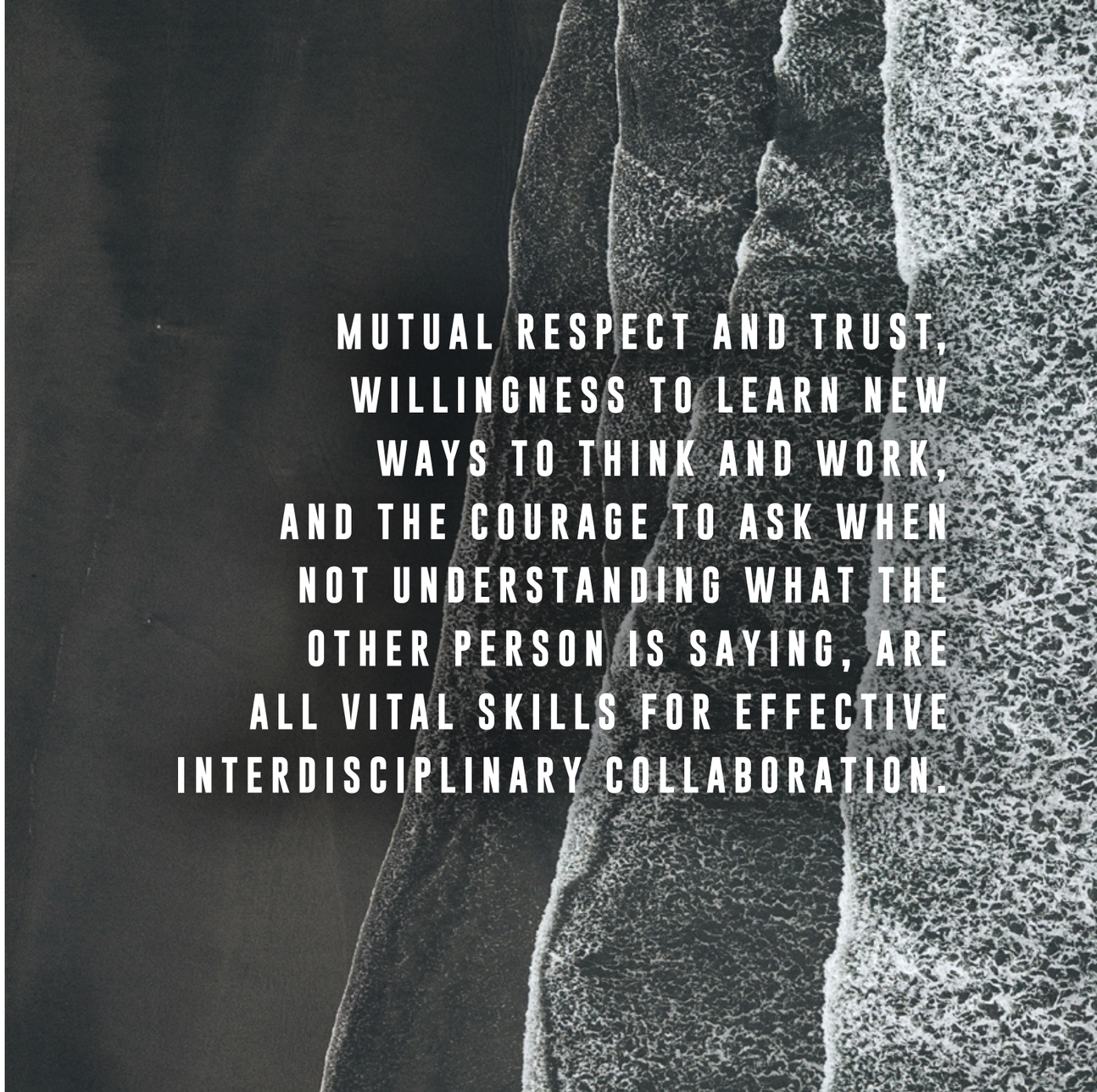
plinary communication and collaboration. As with the human activities in general, comprehensive assessment and understanding of the risks and opportunities posed by maritime transport require cross-disciplinary socio-eco-technical meta-analysis. Thus, professionals with skills and mindsets needed for the interdisciplinary dialogue and collaboration are highly needed. Mutual respect and trust, willingness to learn new ways to think and work, and the courage to ask when not understanding what the other person is saying, are all vital skills for effective interdisciplinary collaboration. One societally important role of the KMRC is to educate experts with such competency.

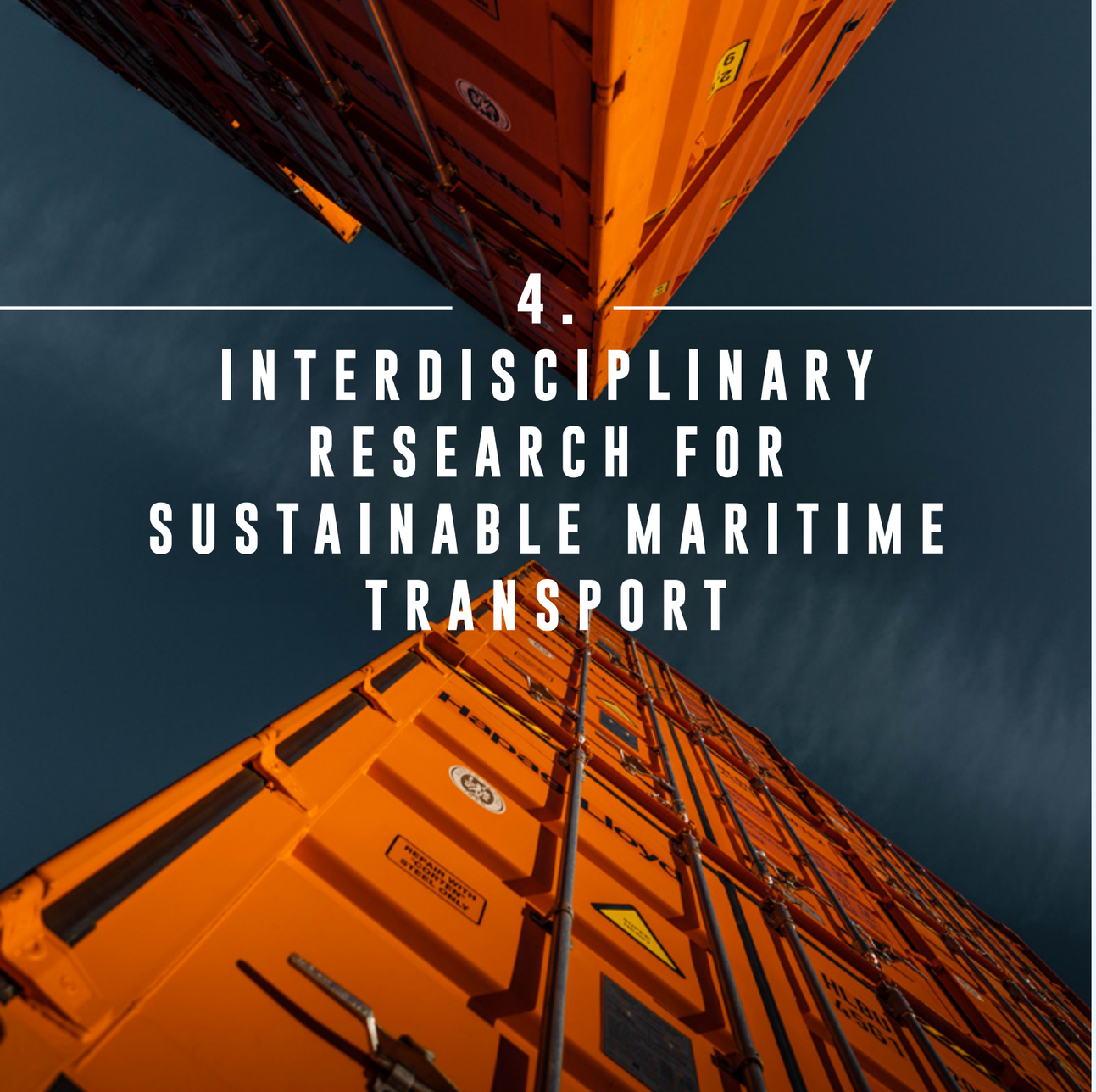
Another key theme in my work in 2021 was the planning of new research projects and the preparation of funding applications. We prepared three successful European regional development funding applications, the most recent one – **VISIIRI** – starting in April 2022. The ongoing green transition of maritime logistics, including the novel technologies enabling it, as well as the various related socio-environmental side effects, is playing a major role in our current plans. However, we will continue working on a wide variety of aspects related to safe and sustainable shipping.

At the local level, the City of Kotka has been taking interesting development steps, with the City Council committing to the start-up of Europe's first port logistics safety park in the Port Kantasatama. An unused 1980's harbor warehouse building is turned into an environment for education, innovation, and piloting to promote the safety and security of the sea environment and society. This provides a promising setting for diverse research activities and stakeholder interaction. I am particularly pleased with the regional co-operation that have been built-up in the context of the safety park development activities between KMRC, the local educational institutions and the city organization.

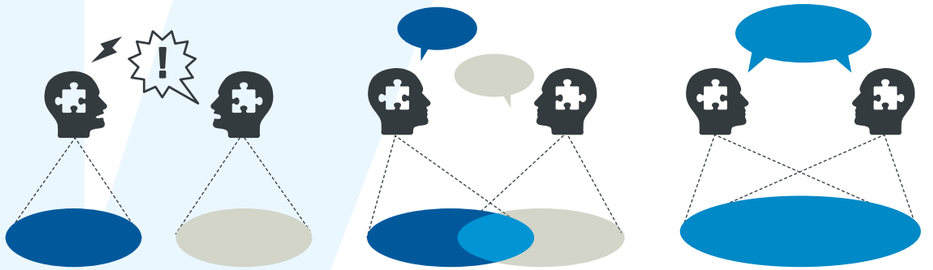
Meetings with numerous stakeholders on divergent occasions have provided a wealth of useful information on current challenges and knowledge needs in the field. I have learned a lot from these discussions and want to thank everyone I have met, hoping that we will be able to develop and maintain a low-threshold dialogue with as many actors as possible.

Research Director
Annukka Lehikoinen





4. INTERDISCIPLINARY RESEARCH FOR SUSTAINABLE MARITIME TRANSPORT



Kotka Maritime Research Centre conducts interdisciplinary research to

1. understand and develop the functioning and dynamics of ship operations and technology, maritime traffic, logistics, and maritime policy-making;
2. assess environmental and safety risks related to maritime traffic, acknowledging the joint effects of other, cumulative stress factors;
3. estimate the positive and negative impacts of maritime traffic on regional wellbeing, safety, and environment;
4. develop new intelligent tools for navigation, maritime spatial planning, and management purposes; and
5. produce information for education and decision-making to support the sustainable development of maritime traffic.

Each research group has its own focus area and scientific field, which are combined in joint research activities in order to address these topics. Based on the results, aim is to support shipping companies, port organisations, maritime/regional planners and other stakeholders in developing their activities in a sustainable way, where the sustainability is achieved by considering the economic, safety-related and environmental aspects together.

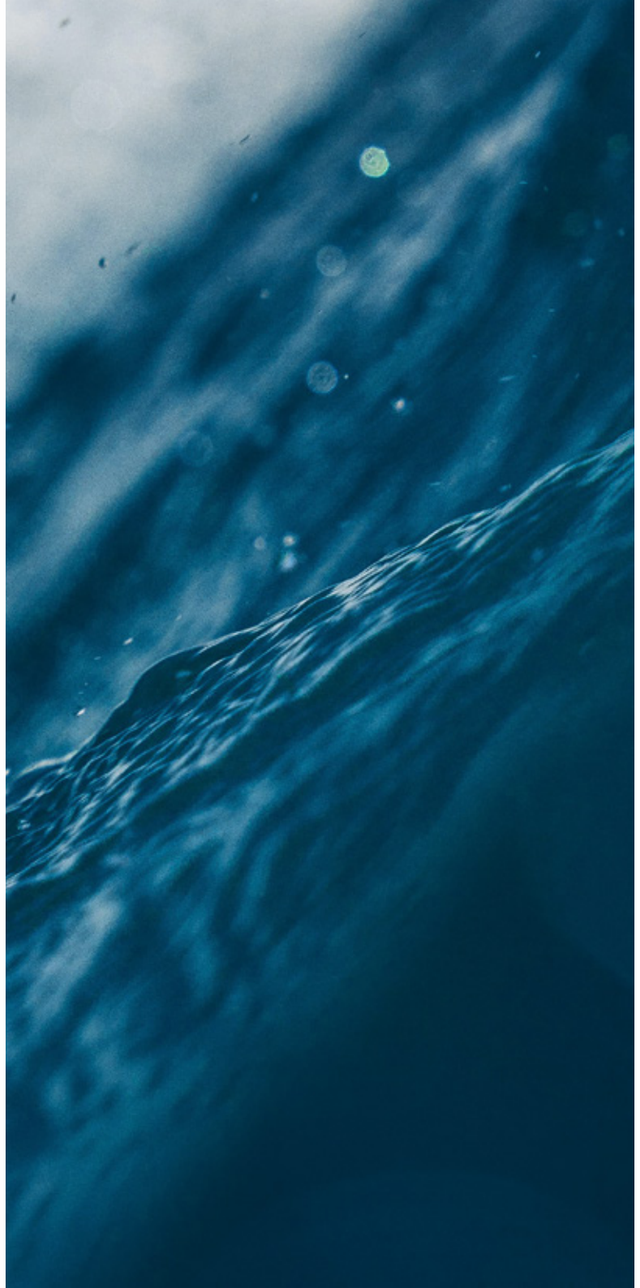
The Aalto University research group offers a diverse research agenda which focuses on analysing the safety of maritime traffic, ships, and structures. In particular, it investigates the responses and strengths of ships in complex physical environments where ice and wave-induced loads are present. The research is carried out by conducting extensive full-scale trials onboard ice-going ships, by utilising the Aalto Ice Tank, and

PENTTI KUJALA

OSIRIS VALDEZ BANDA

by developing theoretical models and analysing the ultimate strength of structures.

The Aalto University research group also investigates system-level issues at the scale of shipping systems/fleets, individual ships, and ship sub-systems. The focus is on passenger ships, ice-going vessels and advanced ship concepts such as autonomous ships. The core value of research is to guarantee safety, to enable sustainability through advanced solutions, and to focus on the first principles of applied mechanics, statistical methods, and systems engineering. The research on safety focuses on developing concepts, methods, tests, and frameworks for creating safe technological and socio-technological systems and for managing the associated risks. These advances in risk analysis and safety science are applied to specific problems in maritime engineering. This serves the society by increasing our understanding of how maritime safety is created and maintained and how safety risks can be effectively managed.



TOMMI INKINEN

Former title of professor (job title research director) in the University of Turku was converted into an actual professor position. The position was defined as the Department of Geography and Geology and the main discipline of the position was economic geography. The study of maritime logistics systems is the main definition of the task.

The research carried out by the research group in the University of Turku includes a diverse research agenda in the fields of maritime industries and logistics, combining business studies and economics with environmental and social sciences. Group specialises in the field of traffic and ports in the Baltic Sea area, as well as logistics chains and infrastructure in the marine industry sector. It coordinates the interdisciplinary environmental research supporting marine spatial planning and integrated coastal zone management.

There are three main spearheads in the research: 1) Shipping and maritime logistics, including: Maritime transport and infrastructure, port networks and port operations, maritime safety studies, pilotage operations and national security of supply. 2) Maritime cluster, including: Development of marine industries, cluster dynamics and economic impacts, corporate social responsibility in shipping operations together with studies focusing on Blue Growth. 3) Marine environment and spatial planning, including: Efficiency and impacts of environmental regulations in shipping, environmental status of ports, marine spatial planning, shipping and offshore activities in the Arctic, performance and impact of the European ports system, and integrated knowledge base and management system for ports.

The Fisheries and Environmental Management Group in the University of Helsinki focus on the interaction between ecosystems and the human society. The research conducted at the University of Helsinki projects combines biology, limnology, fisheries management, geography, and sociology and anthropology. Moreover, mathematical sciences pro-

SAKARI KUIKKA

duce risk models that have their foundation in these sciences.

The research interests of the research group are 1) Decision and risk analysis in relation to renewable resources and biodiversity, 2) Identification and quantification of risks in the use of natural resources and in the various maritime activities, 3) Integrating different sources of data and knowledge: Bayesian analysis, 4) Interdisciplinary modelling of exploitation processes of natural resources in the face of risks and uncertainty of information.

The Bayesian analysis forms the backbone of the group's environmental modelling approach. It provides an effective tool for learning from various information sources. These sources include data, models and their theoretical background, and expert knowledge. For example in oil spill impact analysis, it is important to develop methodology that allows for maximum learning from previous accidents. It is important to understand that the level of uncertainty is typically high in impact predictions. By creating Bayesian models that can learn from previous accidents, it is possible to reduce the number of uncertainties in terms of the potential future accidents.

The applied research at South-Eastern Finland University of Applied Sciences focuses on logistics and seafaring. In the seafaring, the focus is on maritime safety and management of environmental risks related to maritime operations. The main research topics include pollution prevention and spill response management, as well as maritime emergency response and distress operations.

In terms of logistics, the focus is on green transportation, innovative business concepts, and ways to integrate digitalisation and new technologies into port operations. Digitalisation and environmental issues are cross-cutting themes both in logistics and seafaring.

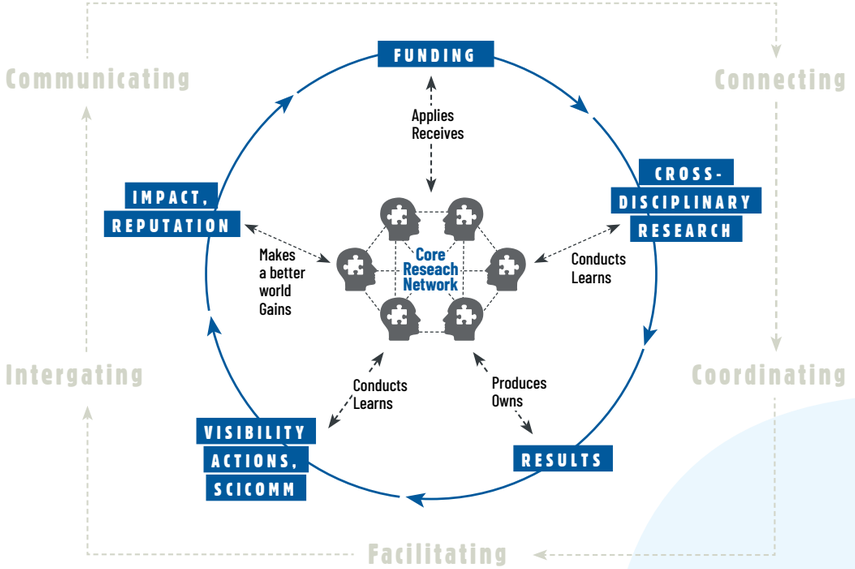
The research projects are need-based and carried out in close cooperation with end-users, providing practical, ready-to-use research results. The research and development activities in logistics and seafaring are conducted by working closely with authorities, companies, and public sector organisations.

OLLI-PEKKA BRUNILA

JOEL PAANANEN

5. CORE RESEARCH NETWORK

One of the objectives listed in the KMRC's action plan for 2021-2022, is the better engagement of researchers to the operation of the centre. As a result of the COVID19 pandemic there had been a lengthy gap in the non-project-related joint activities and the community was scattered. In addition, due to the natural evolution of the research groups, there were many newcomers, not familiar with the KMRC. Therefore, it was a good time to revise and re-launch the network by establishing an introductory seminar and a registration process. As part of this process, as well as in all communications, we have tried to be more specific in bringing out what KMRC is, how we work, and what is



the role of the association in the entity. To engage people, it is important the researchers of the core research network see they are the heart or "engine" of the KMRC, the association being a support body that facilitates the collaboration.

We should aim for a self-feeding system: a sustainable community with its own interdisciplinary working culture and spirit that exists cross the separate projects and is able to sustain itself over the inevitable gaps between funding periods and through the personnel changes.

At the moment the core network consists of 28 researchers and experts who are featured on our website **in a new section** dedicated to them. With this diverse, motivated, and highly international community, it will be interesting to work together for more sustainable maritime transports. In December we got to meet each other on a Christmas cruise on the waves of the Baltic Sea. During the day, in addition to getting to know each other and eating well, we looked for links between our research topics, and identified potential utilities of our network, looking from the perspectives of both the society and the researchers themselves. While writing this, we are already well on our way to planning the concrete actions to make the perceived benefits materialize.

6. COMPLETE PROVIDED SOLUTIONS FOR MANAGING ALIEN SPECIES IN SHIPPING

COMPLETE project (Completing management options in the Baltic Sea Region to reduce risk of invasive species introduction by shipping), and its extension stage COMPLETE PLUS, developed tools for harmonised implementation of the IMO Ballast Water Management Convention, a proposal for a regional biofouling management roadmap, and a proposal of a monitoring programme of non-indigenous species (NIS) for the Baltic Sea. COMPLETE and COMPLETE PLUS were the first full-scale projects funded by the Interreg Baltic Sea Region Programme, led by KMRA.

In the COMPLETE project, scientists and experts from seven Baltic Sea states cooperated with the competent authorities dealing with environmental and maritime issues to find solutions for managing the risks of alien species transported by shipping. This cooperation was carried out together with shipowners and other relevant stakeholders already before the COMPLETE project, and the current knowledge gaps were identified based on the needs of the stakeholders. The overarching role of HELCOM was invaluable, as the joint decisions on these issues are to be taken among the HELCOM countries to achieve regionally harmonized decisions.

The project COMPLETE equipped public authorities around the Baltic Sea and pan-Baltic organisations, like HELCOM and OSPAR, with practical tools to secure the threatened biodiversity and natural ecosystems of the Baltic Sea. By applying a regional approach, the project partners helped to create a system for preventing the introduction and spreading of NIS. In addition, as shipping is an international sector with discussions and agreements made by IMO, the recent ongoing processes at IMO level with regard to the amendment of the Biofouling Guidelines was supported by the outcome of the COMPLETE project. The recommendations for the Baltic Sea can be of valuable support to this review process.

The regional approach is the only way to effectively prevent new introductions and spreading of alien species, as no nation can do this alone. The COMPLETE project was a good example for this kind of regional co-operation. The outputs of COMPLETE are not only relevant for the Baltic Sea, but benefit also the OSPAR region and more widely, world oceans as a whole.

As the COMPLETE project was also a flagship project of the EU Strategy of the Baltic Sea Region and its Policy Area for clean shipping (PA 'Ship'), it supported the aim of the strategy to become a model region for clean shipping. In its extension stage, partners in COMPLETE PLUS aimed to ensure that the outputs and tools from COMPLETE will be implemented in the Baltic Sea region.

Project Researcher
Miina Karjalainen

7. OTHER PROJECTS

NEW PROJECTS

SAFE AND SECURE FUTURE OF LOGISTICS

***Emmi Rantavuo**, South-Eastern Finland University of Applied Sciences*
***Maria Kämäräinen**, Etelä-Kymenlaakso Vocational College*
***Piia Nygren**, Kotka Maritime Research Association*

The project develops and implements collaborative comprehensive security planning based on research data in the context of port logistics. The project compiles and analyses data related to occupational and environmental safety and security, involving the port-related actors of Kymenlaakso region. The aim is to identify especially the comprehensive security and safety risks posed by disruptions, such as corona-like pandemics and extreme weather events, and to assist the actors, through joint innovation and piloting, in their risk assessment and management operation. In this way, project develops the preparedness and resilience of the port sector, important also for national security of supply, to new types of risks and exceptional circumstances that may become more common in the future.

More information

DIGITAL MERIKARHU 2.0

***Maria Kämäräinen**, Etelä-Kymenlaakso Vocational College*
***Miina Karjalainen**, Kotka Maritime Research Association*

The project explores the potential of automation and machine learning, as well as intelligent systems, to improve the fuel economy of the Merikarhu school ship, reducing emissions in a cost-effective way. In addition, Merikarhu is developed towards a modern and diverse digital learning environment that serves both maritime and rescue students as well as stakeholder statutory training activities.

More information

OTHER ONGOING PROJECTS

GETTING READY FOR THE CROSS-BORDER CHALLENGES: CAPACITY BUILDING IN SUSTAINABLE SHORE USE (GETREADY)

Vesa Tuomala,
South-Eastern Finland University of Applied Sciences
Anna Kiiski, *Kotka Maritime Research Association*

The GetReady project studies the development of the coastal region of the Gulf of Finland in accordance with the principles of sustainable development. As part of the project, the use of digital tools related to environmental management to help develop port operations has been explored. In addition, it has been clarified how national and international legislation guides port-related activities. The project team has reviewed current and future legislation and best practices for the development of digitalisation of the port, port operators and shipping companies. As a solution it is seen that growing business, technological development and the goals of sustainable development are an opportunity to be achieved simultaneously, through professional training, the development of management skills and scientific cooperation.

More information

SIMULATORS FOR IMPROVING CROSS-BORDER OIL SPILL RESPONSE IN EXTREME CONDITIONS (SIMREC)

Tarja Javanainen,
Kotka Maritime Research Association
Riitta Kajatkari, *South-Eastern Finland University of Applied Sciences*
Liangliang Lu, *Aalto University*
Mirka Laurila-Pant, *University of Helsinki*

A fundamental pillar of a successful oil-spill response operation is well-considered, responsible, and efficient decision-making. In order to optimise the operations, SIMREC aims to elaborate protocols and tools that allow the persons responsible to enhance their decision-making and communication. The project analyses existing patterns of communication and decision-making, converting the results into a roadmap, and providing recommendations for best national and cross-border practices.

More information

FUTURE POTENTIAL OF INLAND WATERWAYS (INFUTURE)

Tarja Javanainen,
Kotka Maritime Research Association
Fang Li, *Aalto University*
Anna Kiviniitty, *South-Eastern Finland University of Applied Sciences*

The final activities of INFUTURE project were implemented at the end of 2021. The aim of the project was to facilitate and find solutions for sustainable and cost-effective inland waterway traffic. Project studies included feasibility studies about the transportation needs of companies, the legislation and customs policies related to cross border inland waterway transportation. Further, a studies for prolonging navigation period in inland fairways and canal routes was conducted. Five intelligent AtoN's were installed in the Lake Saimaa area (Heinsalmi), and included in a full-scale test of 39 AtoN's in the summer 2021. Additional two AtoN's were installed to the River Neva and the Lake Ladoga. The performance of the devices during wintertime was monitored. A model of a new ship concept was designed and constructed to simulate its ice-going performance in the ice-tank test laboratory ot the Aalto University.

More information

FACTS AND FIGURES

VISION

MERIKOTKA

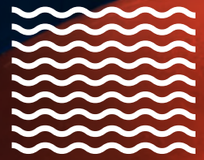
is a pioneer and a respected research centre in the field of multidisciplinary maritime research

RESEARCH THEMES

MARITIME SAFETY

MARITIME INDUSTRIES & LOGISTICS

MARINE ENVIRONMENT



MISSION

RESEARCH FOR SUSTAINABLE MARITIME TRANSPORT

4

DOCTORAL DISSERTATIONS

52

SCIENTIFIC ARTICLES

FUNDING

2,9 M€

THE VALUES

1. WORKING TOGETHER
Learning and solving through interdisciplinary collaboration

2. INNOVATIVENESS
Creating novel and competitive solutionsthrough excellent science

3. HONESTY
Building trust by understanding and communicating the limitations of our research

4. RESPONSIBLY SERVING SOCIETY
Supporting society by proactive value creation and preservation

EMPLOYEES

37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