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Maritime risk assessment in Finland: Analysis of grey literature

Ketki Kulkarni[a]*, Osiris A. Valdez Banda[a], Pentti Kujala[a]

[a] *Aalto University, School of Engineering, Department of Mechanical Engineering, Espoo, Finland*

Abstract

Baltic Sea is an important socio-economic zone for the Baltic region. It is a crucial means of transportation for goods and services. The transportation systems necessitate cooperation among the Baltic countries. Any accident in any area can have significant consequences to the ecosystem and economies of many other neighboring countries. Hence maritime safety and risk management is an important area of research. There are several reviews of scientific work in maritime risk management. However, these reviews often do not include consultancy and industrial research. This paper reviews some of the key research initiatives in Finland focusing on the Baltic Sea in the last 15 years that are not published as scientific articles, but as open access project reports or tools. We analyze this "grey" literature for their underlying methodology and aspect of risk management considered. We also gauge the potential applicability of these works to global maritime risk assessment (MRA).

Keywords: maritime risk management; maritime safety; accident prevention; grey literature; Baltic Sea

1. Introduction

Maritime safety and risk assessment is an important area of research globally. The impact of accidents in the seas often have severe consequences to multiple nations as well as to the ecosystem at large. Identifying risks, mitigating them and preparing for accidents are critical to both passenger as well as cargo ships. Several research groups over the years have worked on theoretical contributions to MRA. Many works have also presented applications and experiments of technology. However, there exists a smaller yet significant body of work outside of the scientific databases in the field of MRA. It is not uncommon to have collaborations between universities, industries and government agencies to work on specific, guided studies for durations of 1-5 years. Often, the outcomes of such collaborations are large reports, open access tools or other online content that are not published in peer-reviewed journals. However, due to diverse expertise that goes into these projects, as well the access to governmental and industrial situations, these projects are often successful in capturing real-life scenarios. These projects can help the scientific community narrow the gap between theoretical research and practical applications. This article presents a review of the key grey literature in MRA from Finland in since 2005 and points out future directions of research. This includes articles published by practitioners in non-scientific journals, project reports, and other forms of documentation outside of scientific literature. The projects selected have been specifically initiated to address issues pertaining to the Baltic Sea, Gulf of Finland or to the Baltic region.

* Corresponding author. Tel.: +358-5047-01904;
E-mail address: Ketki.kulkarni@aalto.fi

2. Risk management initiatives in Finland

In this section some of the key projects since 2005 have been discussed. The projects have been cited by the leading coordinating organization. The main risk management questions addressed by each of the projects is analyzed. Further investigations are carried out to understand how relevant these questions are to Baltic Sea in particular and to global R&I in MRA in general.

Table 1. A summary of research in maritime risk analysis.

	Project	RM question	Method(s) used	Baltic area addressed	Relevance to global MRA
1.	OILECO, *SYKE et al.* (2007)	How to use nature values in decision support to safeguard populations, habitats from oil spills?	Bayesian networks	Ecosystems in GoF	Partly applicable
2.	METKU, *KMRC* (2010)	How to improve safety culture in maritime traffic?	Tools, data analysis	Baltic Sea	Partly applicable
3.	BRISK, *HELCOM et al.* (2011)	How do we increase cooperation among authorities to increase preparedness and response for oil spills?	Calculating probabilities, generating maps and scenario comparison	Sub-regional cooperation	No defined framework, hence not scalable
4.	IBAM, *University of Helsinki et al.* (2011)	How do we build an integrated model that uses knowledge of selected processes (Herring overfishing, common eider hunting, eutrophication, oil spills) for management?	Bayesian models	Environmental management of GoF	Framework development identified as future work, not scalable directly
5.	SAFGOF, *KMRC et al.* (2011)	What are the estimated traffic levels in 2015 and their impact on risk levels for ship collisions and groundings?	Bayesian Belief Networks	Maritime traffic in the Gulf of Finland	Partly applicable, due to focus on training
6.	MOPO, *KMRC et al.* (2011)	How to disseminate information for ports to reduce congestion?	Data analysis	Kymenlaakso	Partly applicable
7.	STOCA, *KMRC et al.* (2011)	How are cargo flows affected in emergency situations?	Simulation, data analysis	Baltic Sea	Partly applicable
8.	EfficienSea, *KMRC et al.* (2011)	How to use navigation to improve maritime safety and environment?	Data analysis	Baltic Sea	Partly applicable
9.	PROBAPS, *SYKE et al.* (2012)	Is there a benefit to the costs on combating eutrophication oil spills, and alien species invasions?	3D marine modelling, Bayesian risk analysis	Baltic Sea	Modelling framework may have applications
10.	OILRISK, *KMRC et al.* (2013)	How can we apply ecological knowledge to develop practical oil spills response?	Bayesian networks	Ecology of GoF	Management and planning insights
11.	CARING *University of Turku et al.* (2013)	How do we secure cargo to prevent fall off, based on IMO guidelines?	Reviews, expert guidance	Any sea voyage	Guidelines are applicable to global voyages
12.	Maritime Hubs, *University of Turku et al.* (2013)	How do structural changes in EU affect maritime in the region?	Surveys of experts	EU	Framework may be applied to larger areas

13.	PENTA, *University of Turku et al.* (2013)	How can the 5 key ports of the Baltic address challenges of the future?	Analysis of current data and future forecasts	Baltic Sea	Not applicable
14.	Chembaltic, *University of Turku et al.* (2013)	What are the risks for chemical accidents in Baltic?	Statistical analysis	Baltic Sea	Not applicable
15.	StarDust, *University of Turku et al.* (2013)	How can we improve operations of Baltic ports?	Transnational clusters and operational modelling	Baltic Sea Region	Not applicable
16.	CAFÉ, *KMRC et al.* (2013)	How to increase availability of information relating to safety?	Data analysis, Bayesian models, surveys	Baltic Sea Region	Management frameworks applicable
17.	TOPCONS, *KMRC et al.* (2014)	How to plan for sustainable use and management of water bodies?	Map-based tool	Eastern GoF	Not directly applicable, could guide future studies
18.	MIMIC, *KMRC et al.* (2014)	How can proactive management help minimize oil spills?	Simulation model, Bayesian decision support model	GoF	Risk governance framework may have applications
19.	WINOIL, *KMRC et al.* (2014)	How to improve maritime safety and oil spill control in ice conditions?	Ice navigation simulation	Baltic Sea	Applicable to ice conditions
20.	CHIP, *University of Turku et al.* (2015)	How can companies aim for sustainability and stricter environmental regulations?	Management studies	Baltic Sea, GoF	Framework may be applied to other seas for dedicated studies
21.	FAROS, *Aalto University et al.* (2015)	How to mitigate human error through risk-based design?	Concept design, risk modelling	All	Applicable to global setting
22.	WINMOS *Aalto University et al.* (2015)	How to develop winter navigation systems to safeguard recourses?	Simulation	Baltic Sea	Applicable to ice areas
23.	Vessel TRIAGE, *Aalto University et al.* (2015)	How to assess safety of vessel for all onboard?	Tool development	All	Applicable to global situations
24.	POLARCODE, *University of Turku et al.* (2016)	How can IMO's polar code for Arctic waters be implemented in Finland?	Review and analysis	Finnish Ports	Not applicable
25.	SMP Dev, *University of Turku et al.* (2016)	What are the development needs of small and medium sized ports?	Statistical analysis	Baltic Sea Region	Analysis framework scalable
26.	Managing ports' environmental impact, *KMRC et al.* (2016)	What is the impact of environmental practices on ports' competitiveness?	Data analysis	Baltic Sea Region	Framework applicable
27.	SMPorts, *University of Turku et al.* (2017)	How can we enhance the services in small and medium ports?	Review and survey	Baltic Sea Region	Not applicable
28.	BONUS STORMWINDS, *Aalto University et al.* (2017)	How to enhance maritime safety in winter using science-based analyses?	Tool development, STAMP studies	Baltic Sea	Partly applicable
29.	SmartSea *University of Turku et al.* (2017)	How will the Gulf of Bothnia change in next decades and how to mitigate human induced strain?	Review and analysis, statistical modelling	Gulf of Bothnia	Not applicable
30.	Low-Carbon Ports, *KMRC et al.* (2017)	How to reduce carbon footprint of ports?	Data analysis	Finnish ports	Framework may be applicable

31.	ÄlyVesi, *NOVIA et al.* (2018)	How to test new safe-based solutions for intelligent water transport?	Tool development	Finish urban waterways	Framework applicable
32.	OpenRisk *HELCOM et al.* (2018)	How can we improve regional pollution preparedness and response to accidents such as oil spills?	Different for various tools	European seas	Open access tool box
33.	30Miles, *KMRC et al.* (2018)	How do we plan for sustainable development with port safety and environmental practices?	Survey, Risk assessment	Eastern Gulf of Finland	Framework may be applicable

More details about these projects, such as funding agencies and collaborating partners may be found on our project website mentioned in the references.

3. Discussion

This article reviewed 33 projects on maritime risk assessment in the Baltic region from 2005 onwards. These projects addressed diverse topics within maritime safety: traffic issues, port design, winter navigation, ship design, accident prevention and response, ecological safety, environmental practices, efficient management and future challenges. Different types of deliverables were obtained such as guidelines, training materials, open access tools, frameworks and models. These outcomes were expected to aide in decision support, policy implementation, design, planning and operations. The modelling approaches primarily involved probabilistic risk assessment, statistical analysis, Bayesian models and simulation. Although most of the projects focused on a specific regions such as Baltic Sea, GoF or Gulf of Bothnia, the underlying principles of the study may be applicable to other parts of the world too. Some of the projects such as EfficienSea have clearly identified the framework of the study and documented the steps of the project in training materials. These projects have the potential to be adapted to global scenarios with minimum effort.

These projects are work of expertise and effective collaboration among leading groups in maritime research. As part of future work, it would be interesting as well as important to see how the projects from the early years are being used today and to what extent they are still relevant. It will also be worth investigating common principles from these projects that may be identified as key elements for future projects. Further, steps could be identified to make the projects globally more relevant, such as framework documentation. Lastly, easy access of the materials from these projects can go a long way to help future researchers.

4. Conclusions

While many projects presented useful applications of theoretical modelling approaches, due to a lack of clear framework, it is hard to scale these solution approaches to a global problem. Projects that have included a description of the required training for the models and the methods for collecting inputs are better adept for application to a wider scope.

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