

# Risk Management in Seaports

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# Agenda

- 1** Risk management in seaports – necessity and HAZARD project background
- 2 Risk management process
- 3 Risk assessment - risk sources
- 4 Risk assessment - methods
- 5 HAZARD online toolbox
- 6 Conclusion and outlook

# Seaports in global supply chains

- More than **80 percent** of global trade is forwarded by sea.
- Seaports possess different **hazard sources** and often are located near **residential areas**.
- Seaports need to follow an immense number of **regulations** and **standards**.
- Clear **roles** and **responsibilities** for the activities related to risk management are required.
- Inadequate **risk assessment** and **risk treatment** can lead to major **disasters!**

# Examples of Port Accidents and Risks

## **Port: Tianjin 2015**

„ Analysis of Tianjin Port Explosion:  
Risk management is the key“  
[www. Swissre.com.de](http://www.Swissre.com.de), 25.07.2016

## **Port: Beirut 2020**

„Explosion of 2,750 tonnes of highly  
explosive ammonium nitrate“  
[www.arabnews.com](http://www.arabnews.com), 07.08.2020

## **Port: Gdynia 2016**

„Bulk carrier Olga Topic caught fire in cargo  
holds during cargo handling operations“  
[www.newsmaritime.com](http://www.newsmaritime.com), 25.01.2016

## **Port: Hamburg 2016**

„ Hamburg Port: Caustic vapours emitted  
due to chemical accident“  
[www. spiegel.de](http://www.spiegel.de), 21.03.2016

## **Port: Kiel 2009**

„Severe explosion shocked Port of Kiel“  
[www.abendblatt.de](http://www.abendblatt.de), 13.06.2009

# Potential Consequences of Accidents and Incidents in Seaports

- Port closure
- Damage to people, property and the environment
- Service delays or disruption of supply chains
- Long term damage to country or regional reputation

# The HAZARD Project

## Research motivation and project objectives

- Risk management in ports is important for ensuring reliability, supply chain resilience, as well as transport safety and security.
- Risk analyses and assessments are vital to nearly all stakeholders of a port, such as logistics operators, rescue services, civil protection agencies.
- HAZARD aims at supporting project partners and their peers to better understand and apply risk management methods for a better mitigation of risks in seaports.

For detailed project information see Ojala, L., Whiteman, M., Malmsten, J. (2016) and/or <http://blogit.utu.fi/hazard/>



# The HAZARD Project

## The HAZARD Project

### In a Nutshell...

HAZARD helps to mitigate emergencies in major seaports and to improve related safety and security preparedness in the Baltic Sea Region (BSR).

### Key Data:

- 3 year project period, Spring 2016 –Spring 2019
- Total budget EUR 4.4 million (approx. USD 4.96 million)
- Co-funded by EU Interreg Baltic Sea Region Program

### Partners:

- Rescue services as national, regional or local authorities
- Major seaports in the BSR (TEN-T Core network ports)
- Related logistics service providers
- Universities as knowledge partners
- Associated organisations

# The HAZARD Project Structure

## **WP1 Project Management and Administration**

→ Lead Partner: University of Turku (FI)

## **WP2 Joint Exercises and Communication in Emergencies**

→ WP Leader: Southwest Finland Emergency Services (FI)

## **WP3 Regulatory Framework on Safety & Security**

→ WP Leader: University of Borås (SE)

## **WP4 Risk Assessment and Analysis**

→ WP Leader: Hamburg University of Technology (DE)

## **WP5 Equipment Testing**

→ WP Leader: Hamburger Hafen und Logistik AG, HHLA (DE)

Dissemination



# Objectives and Research Questions of HAZARD Work Package 4

## Objectives

- Determine the current state and level of knowledge regarding risk management among relevant seaport stakeholders
- Determine the target group-specific requirements for the application of risk management methods

## Research Questions

- RQ1: *Which risks play a major role in seaports?*
- RQ2: *Which risk assessment and treatment methods are currently applied in seaports?*
- RQ2: *To which extent do seaport actors cooperate with respect to their risk management activities and how can the cooperation be improved?*



**A comprehensive toolbox for risk management in seaports has been developed as one major result of the HAZARD work package 4**

# HAZARD WP4 Core Contributors

- PP1: University of Turku
- PP2: Hamburg University of Technology
- PP4: Viimsi Municipality
- PP6: Vilnius Gediminas Technical University
- PP10: University of Borås
- PP15: Polish Safety and Reliability Association



We are grateful to our work package members for their **manifold contributions** as well as for the excellent **cooperation** with the other **partners** from all work packages in the **WP4 meetings and workshops**

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Risk management in seaports – necessity and HAZARD project background

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**Risk management process**

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Risk assessment - risk sources

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Risk assessment - methods

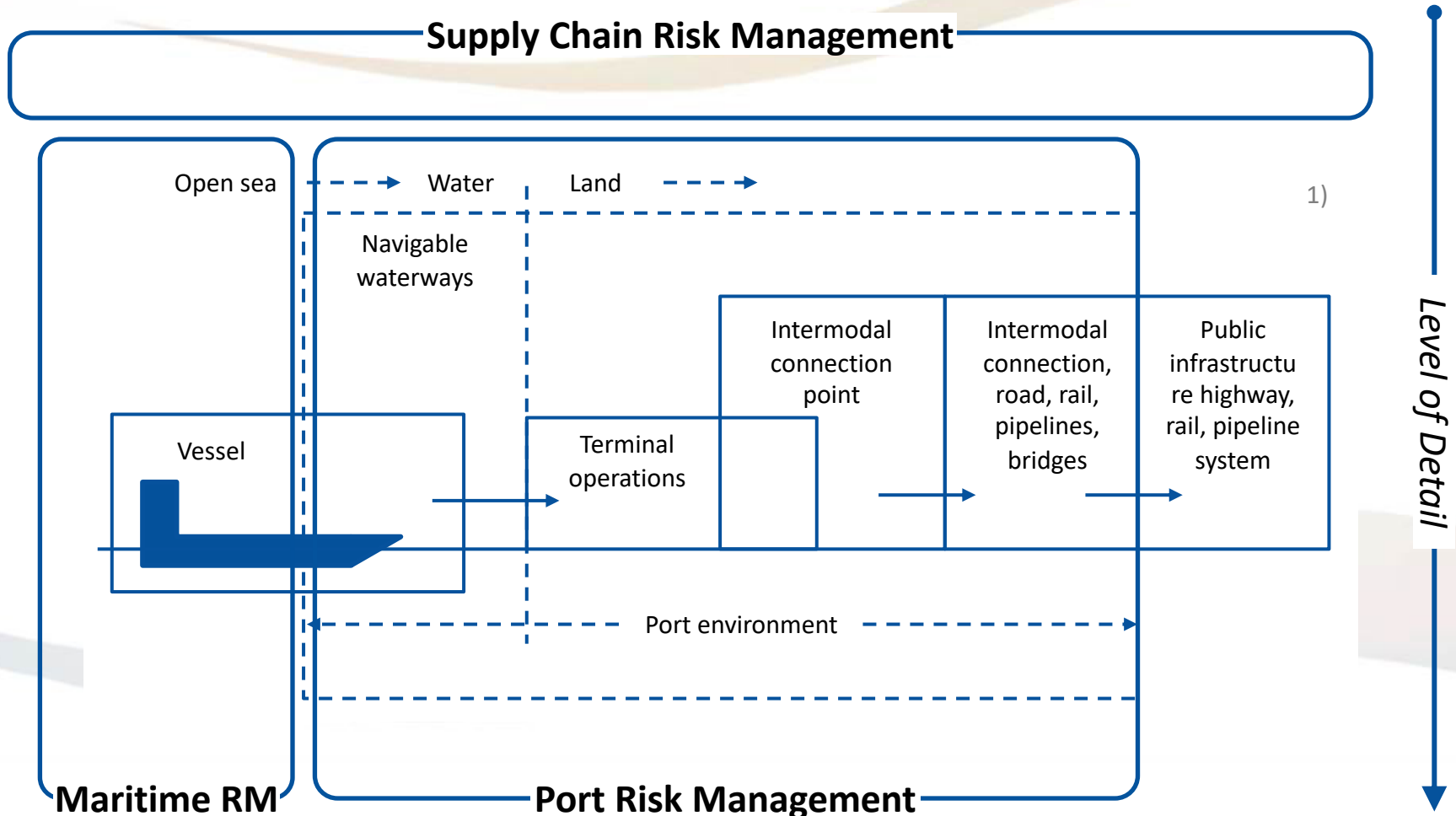
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HAZARD online toolbox

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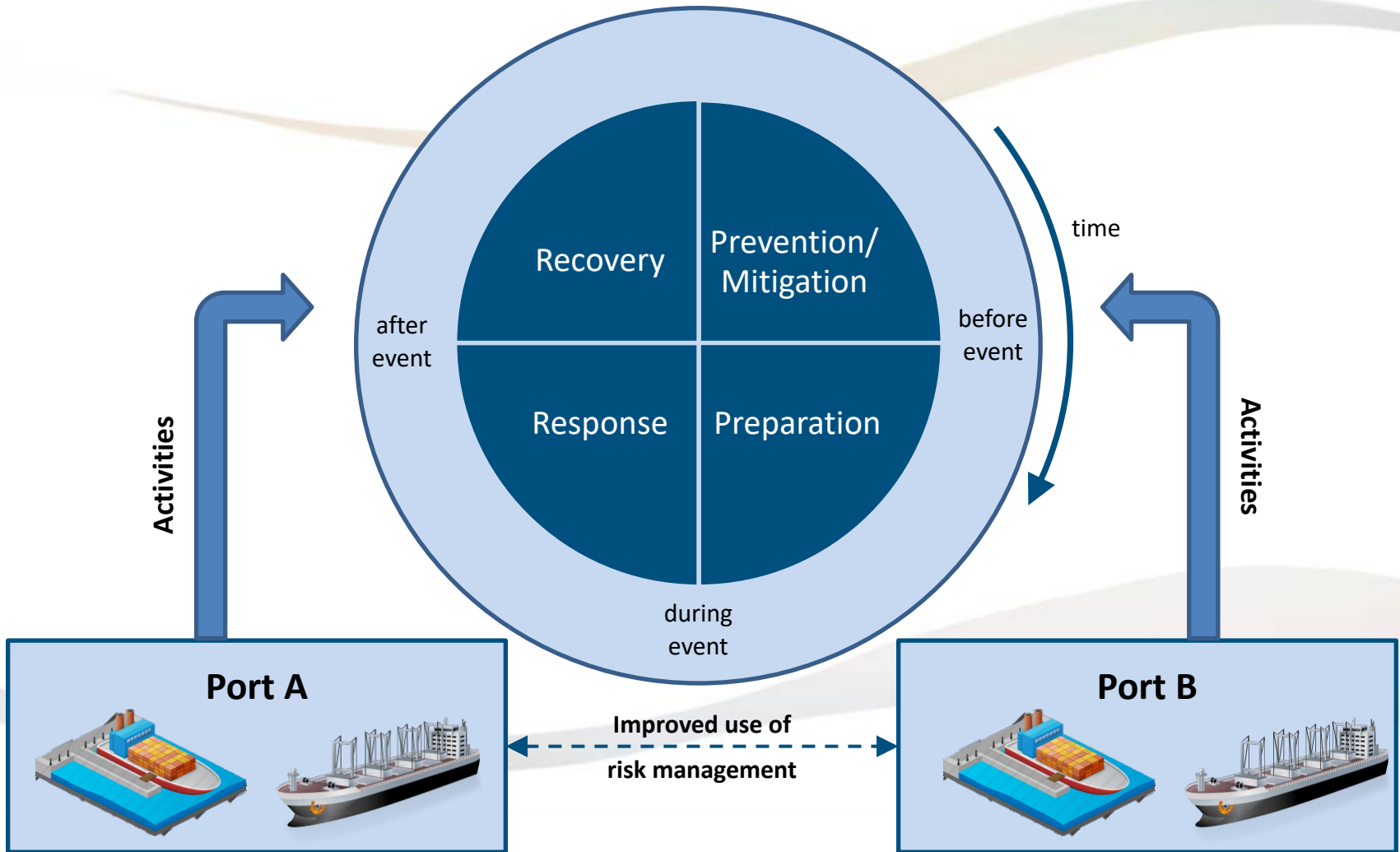
Conclusion and outlook

# Context of Port Risk Management



1) John et al. (2016), p. 139

# Risk management in seaports



modified from Jaques (2007), Morrison (2013),  
Waugh (1990), Laakso (2014)

# RM definitions in BSR seaports

*“Risk management is the **systematic identification** of risk factors and preventive activities with the **implementation** of measures to **limit** the effect of different risks.”*

#POK1

*“Risk management is doing everything **economically** possible to **prevent** and **mitigate** possible risks.”*

#POT1

*“[The] **risk group** consists of **couple of individuals**, organizing **risk mappings** for different units/divisions [that are] responsible for the summaries of the key risks going to the management group.”*

#POF4

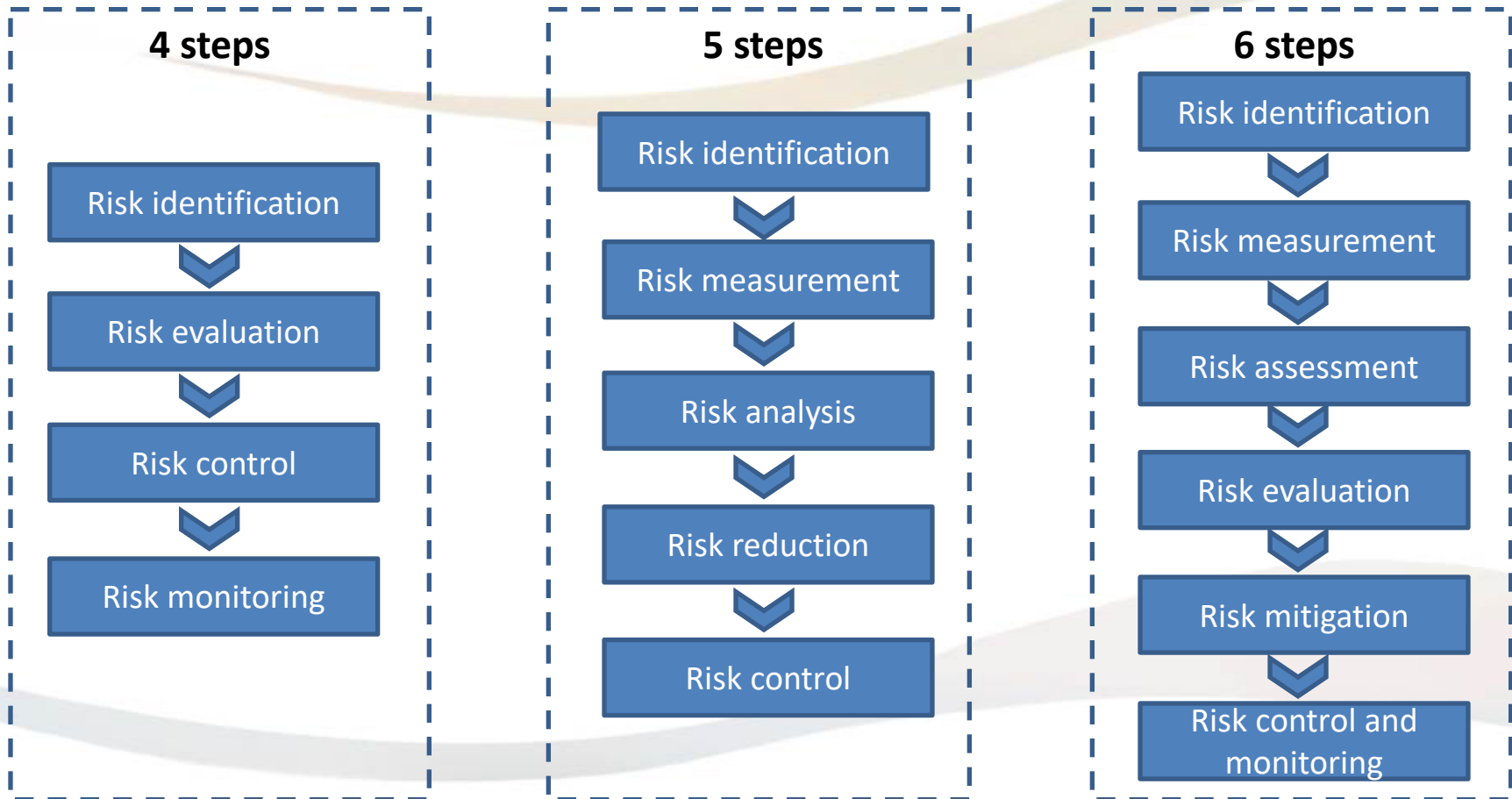
*“Our **operational risk management** is based in the **nautical headquarters**. That has five navigators who are all authorized to make decisions. We also have **instructions** for each situation and scenario.”*

#POH14



Need for a **standard process**

# Risk management process schemes



➤ **ISO 31000:2018** as a standard process scheme for **risk management**

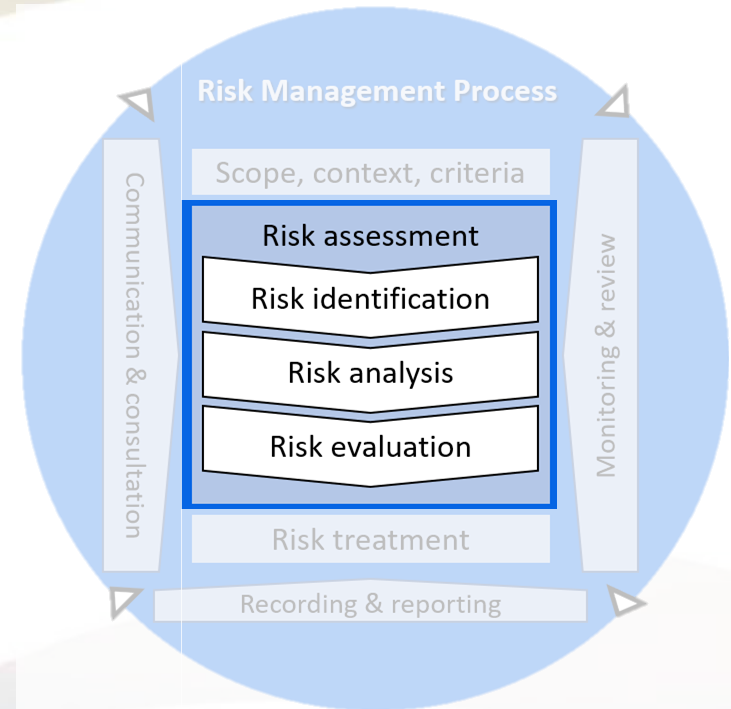
# ISO 31000:2018 development process

- International Organization for Standardization (ISO) is the world's largest developer and publisher of International Standards.
- ISO31000:2009 was published in November 2009 and it is the result of four years of consultation between risk and standards experts in 30 countries.
- It pulls together and replaces a number of similar international standards. AS/NZS 4360:2004, which was due for revision in 2009, formed the basis of ISO31000.
- Updated guidelines ISO31000:2018 introduced in 02.2018.



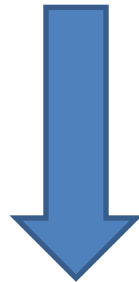
# ISO 31000:2018 risk assessment process

- **Risk identification**
  - Identify sources of risk, areas of impact and consequences
- **Risk analysis**
  - Estimate probability of event occurrence
  - Estimate severity of consequences in case of event occurrence
  - Combine probability and consequence in risk scale
- **Risk evaluation**
  - Compare the level of risk established in the previous stage with the risk tolerance criteria established



# ISO 31000:2018 characteristics

- ISO 31000:2018 is not intended for certification.
- It does not contain compulsory requirements.
- It is a collection of suggested best practices.



- Guide to help in developing specific processes
- Flexible application

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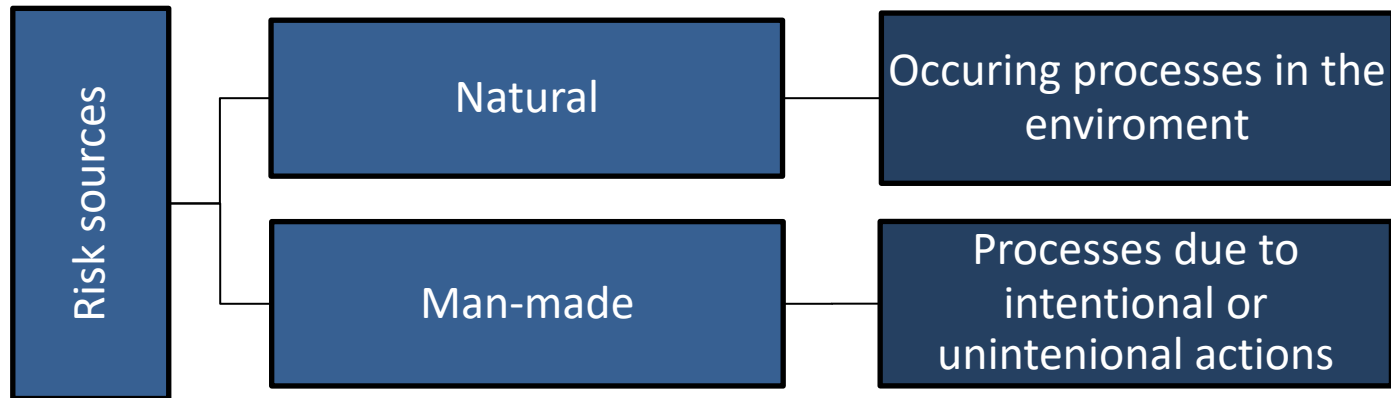
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HAZARD online toolbox

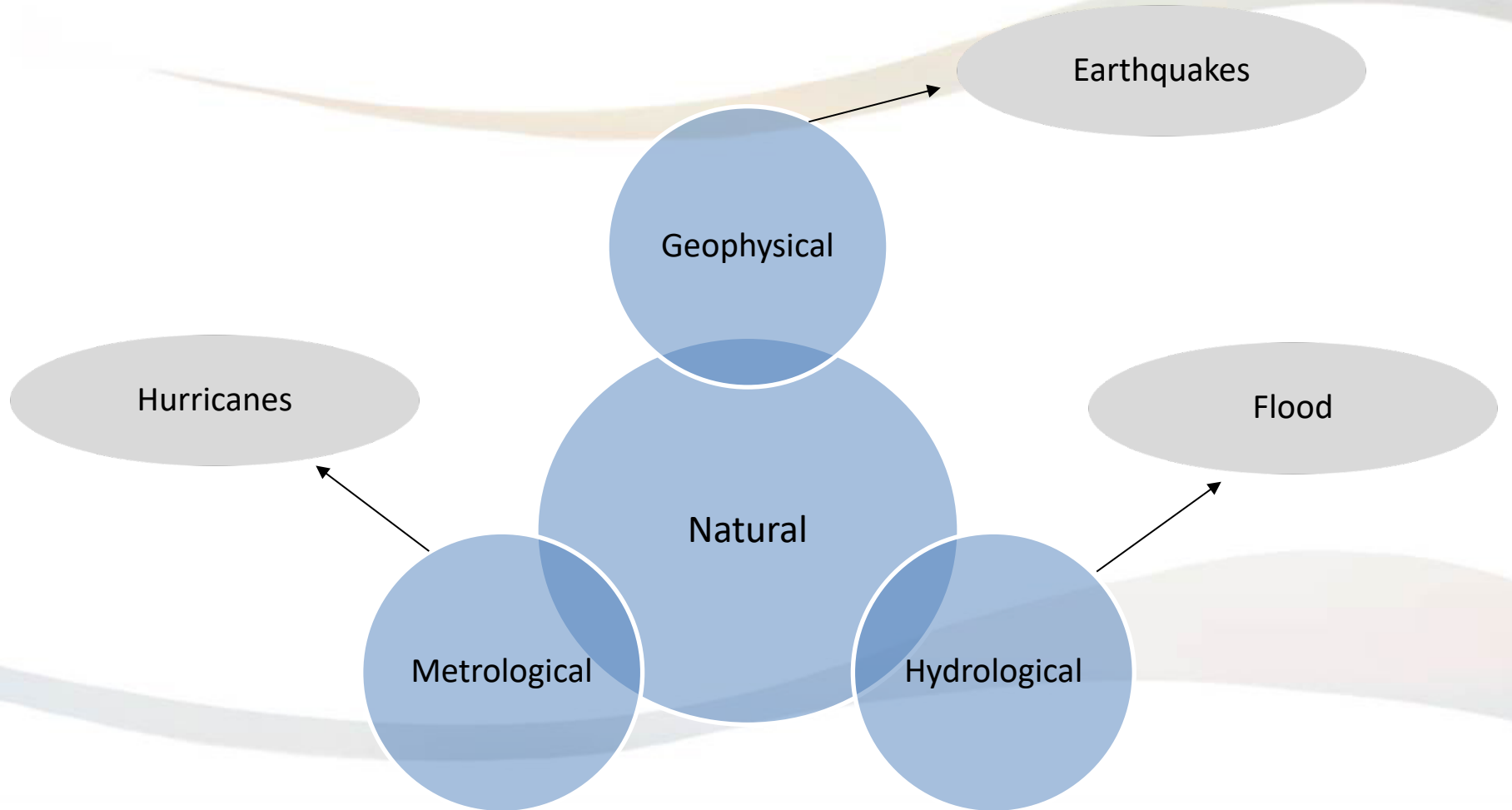
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Conclusion and outlook

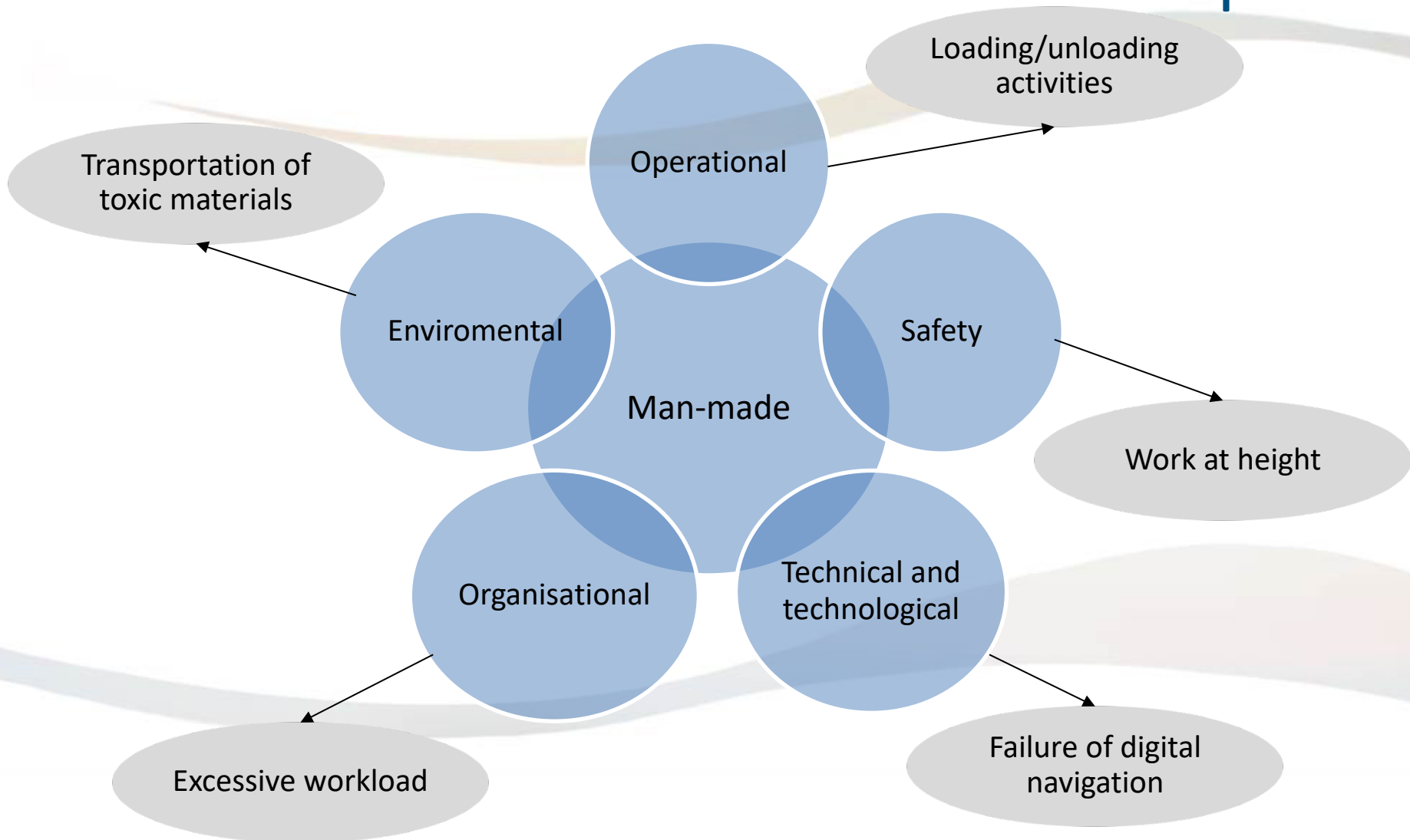
# Groups of risk sources



# Breakdown of natural risks: examples



# Breakdown of man-made risks: examples



modified from Jaques (2007), Morrision (2013),  
Waugh (1990), Laakso (2014)

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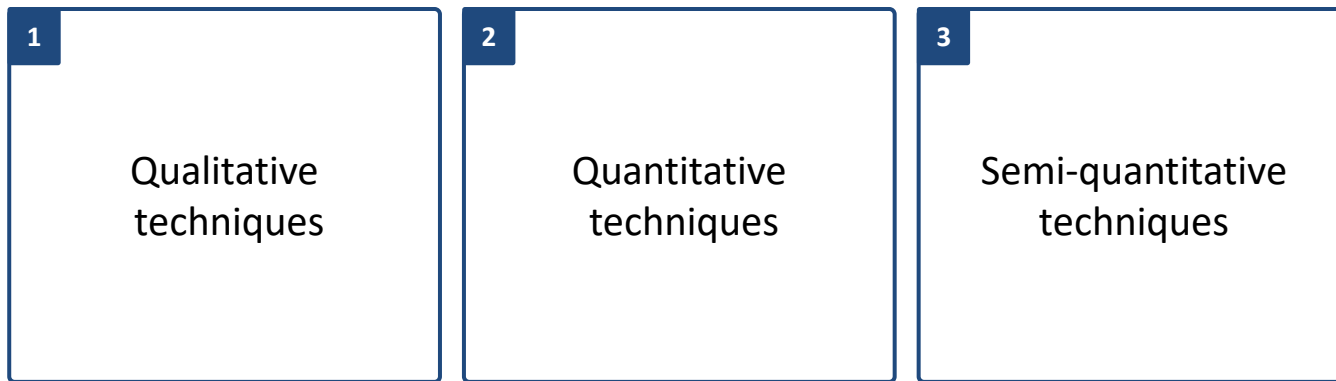
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# Risk assessment methods





# Risk assessment methods

|   |  |  |
|---|--|--|
| <p>1</p> <p>Qualitative techniques</p>  | <p>2</p> <p>Quantitative techniques</p>  | <p>3</p> <p>Semi-quantitative techniques</p>   |
| <ul style="list-style-type: none"><li>• Is used whenever there is a lack of information, resources and/or time</li><li>• <b>Subjective evaluation of the probability and severity</b></li></ul> | <ul style="list-style-type: none"><li>• Is used in more complicated or high-technology industries</li><li>• <b>probabilistic approach to rank and appraise risks</b></li></ul> | <ul style="list-style-type: none"><li>• Combination of qualitative and quantitative techniques</li><li>• <b>intermediary approach to judge risks</b></li></ul> |

# Risk assessment methods in BSR (1): Risk Identification (excerpt)

|           | Delphi method | Meetings within own organization | Meetings with other stakeholders | Offline software | Online solution |
|-----------|---------------|----------------------------------|----------------------------------|------------------|-----------------|
| Sweden    | 0%            | 80%                              | 70%                              | 10%              | 10%             |
| Estonia   | 0%            | 67%                              | 78%                              | 11%              | 22%             |
| Finland   | 7%            | 93%                              | 86%                              | 7%               | 36%             |
| Denmark   | 0%            | 75%                              | 63%                              | 13%              | 38%             |
| Lithuania | 12%           | 76%                              | 71%                              | 0%               | 0%              |
| Germany   | 2%            | 63%                              | 46%                              | 12%              | 17%             |
| Poland    | 11%           | 44%                              | 56%                              | 33%              | 0%              |

\*Comparison of the risk **identification** methods as percentage of respondent by country (HAZARD survey: 108 responses)

# Risk assessment methods in BSR (2): Analysis and evaluation (excerpt)

|           | FMEA | Risk matrix | Checklists | Hazard diamond | Measuring devices |
|-----------|------|-------------|------------|----------------|-------------------|
| Sweden    | 20%  | 80%         | 80%        | 0%             | 30%               |
| Estonia   | 11%  | 56%         | 44%        | 0%             | 33%               |
| Finland   | 21%  | 64%         | 86%        | 21%            | 43%               |
| Denmark   | 13%  | 50%         | 75%        | 0%             | 25%               |
| Lithuania | 12%  | 41%         | 47%        | 29%            | 41%               |
| Germany   | 15%  | 51%         | 59%        | 7%             | 20%               |
| Poland    | 33%  | 44%         | 22%        | 0%             | 22%               |

\*Comparison of the risk **analysis** and **evaluation** methods as percentage of respondent by country (HAZARD survey: 108 responses)

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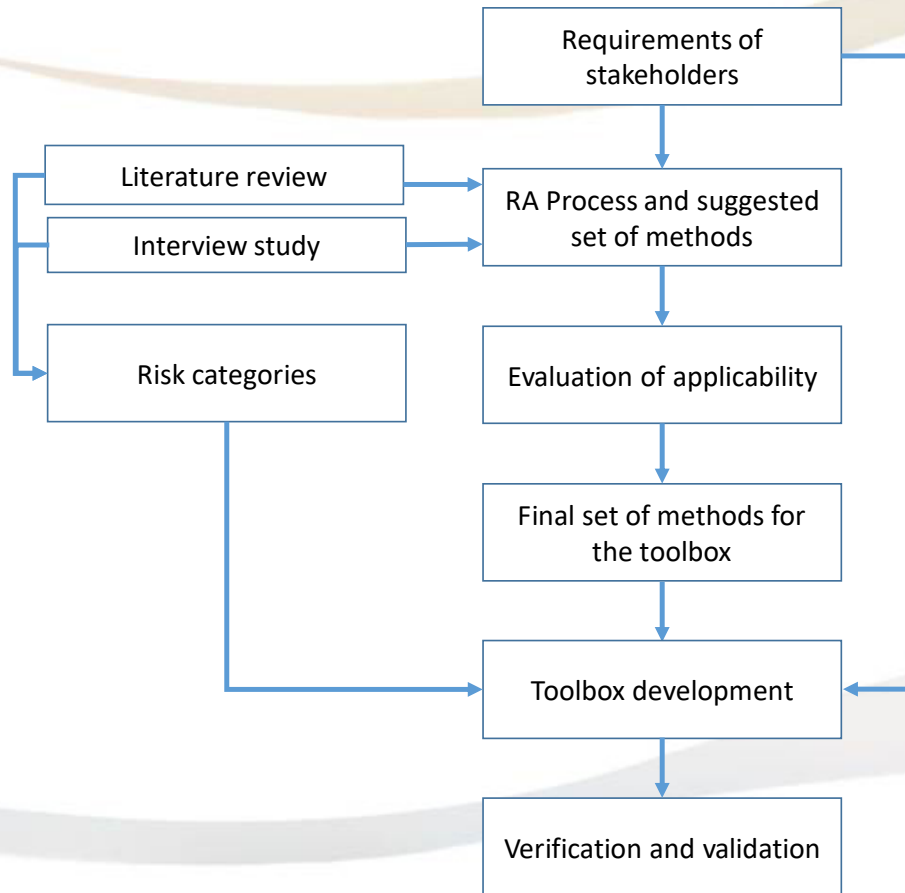
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**HAZARD online toolbox**

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Conclusion and outlook

# Input and development steps of the toolbox



Vimsii Municipality



# HAZARD risk assessment toolbox

**TUHH**  
Technische Universität Hamburg

**HAZARD** Interreg  
Baltic Sea Region

EUROPEAN REGIONAL DEVELOPMENT FUND  
EUROPEAN UNION

HOME | ISO 31000 | RISKS | RISK ASSESSMENT METHODS | HAZARD TOOLBOX | USER GUIDE

## RISK ASSESSMENT IN SEAPORTS

Understanding methods and promoting applications with regards to risk assessment (WP leader: Hamburg University of Technology).

[READ MORE](#)





<https://hazard.logu.tuhh.de>

# HAZARD risk assessment toolbox

The screenshot shows the HAZARD risk assessment toolbox interface. At the top, there are logos for TUHH (Technische Universität Hamburg), HAZARD, Interreg Baltic Sea Region, and the European Union. Below the logos is a navigation menu with the following items: HOME, ISO 31000, RISKS, RISK ASSESSMENT METHODS, HAZARD TOOLBOX (highlighted in red), and USER GUIDE. The main content area is titled "HAZARD TOOLBOX" and contains a description: "The hazard toolbox is organized as a layered form to be filled out by the user to narrow down the risk assessment methods based on his/her defined criteria including the risk and method type as well as the required effort and complexity of the method." Below the description is a progress bar with five steps: 1 Risk Groups, 2 Risk Types (highlighted in red), 3 Risks (with 25% progress), 4 Method Properties, and 5 Complete. Under the "Risk Types" step, there are three checkboxes:  Geophysical,  Hydrological, and  Metrological. At the bottom of the interface, there are three buttons: "< Previous Page", "Next Page >", and "Reset".

<https://hazard.logu.tuhh.de>

# HAZARD risk assessment toolbox




[HOME](#) [ISO 31000](#) [RISKS](#) [RISK ASSESSMENT METHODS](#) [HAZARD TOOLBOX](#) [USER GUIDE](#)

## RISK GROUPS

### ENVIRONMENTAL

Potential threats of diverse sources affecting organisms and environment by emissions, leakages etc.


[More Risk Types](#)



### NATURAL DISASTERS

A natural disaster is a natural change in the Earth's surface or atmosphere potentially having devastating effects.


[More Risk Types](#)



### OPERATIONAL

Operational risks are related to the occurrence of unexpected events or accidents disturbing the flow of daily operations.


[More Risk Types](#)



### ORGANISATIONAL

Organisational risks are related to inadequate structure or failed internal processes, people and systems.


[More Risk Types](#)



### SAFETY

Safety risks are closely related to the continual compliance and monitoring of enforced safety regulations.


[More Risk Types](#)



### TECHNICAL AND TECHNOLOGICAL

Risks that are connected to the potential failure of devices, machinery and the corresponding IT-software.

[More Risk Types](#)



<https://hazard.logu.tuhh.de>



# HAZARD risk assessment toolbox

The screenshot shows the HAZARD risk assessment toolbox website. The navigation bar includes links for HOME, ISO 31000, RISKS, RISK ASSESSMENT METHODS (highlighted), HAZARD TOOLBOX, and USER GUIDE. A dropdown menu under RISK ASSESSMENT METHODS lists: RISK IDENTIFICATION, RISK ANALYSIS (CAUSES & THREATS), RISK ANALYSIS (CONSEQUENCES), RISK ANALYSIS (LIKELIHOOD), RISK ANALYSIS (SEVERITY), and RISK EVALUATION. The main content area is divided into two sections: RISK ASSESSMENT METHODS and METHOD PROPERTIES. The RISK ASSESSMENT METHODS section contains three columns: RISK IDENTIFICATION, RISK ANALYSIS, and RISK EVALUATION. Each column has a descriptive paragraph and a 'Methods' button. The METHOD PROPERTIES section contains three columns: COMPLEXITY, EFFORT, and METHOD TYPE, each with a descriptive paragraph and a 'Methods' button.

**HOME** **ISO 31000** **RISKS** **RISK ASSESSMENT METHODS** **HAZARD TOOLBOX** **USER GUIDE**

**RISK ASSESSMENT METHODS**

This section of the webpage enables the assessment process according to ISO 31000, consequences, likelihood, and severity of risks.

**RISK IDENTIFICATION**

This step demands the organization to identify sources of risk, areas of impacts, their causes and potential consequences. The aim of this step is to generate a comprehensive list of risks that might negatively impact the organization, harm the people and/or the environment. This step should be continuously monitored based on any changes in the environment.

**Methods**

**RISK ANALYSIS**

This step aims in analyzing the identified risks based on the associated causes and consequences along with their likelihood and severity respectively. Risk analysis provides an input to risk evaluation and to decisions on whether risks need to be treated, and on the most appropriate risk treatment strategies and measures.

**Methods**

**RISK EVALUATION**

This step aims at the prioritization of the identified risks that have been analyzed in the analysis phase. This is in order to assist in making decisions about the risks that need urgent treatment. Risk evaluation involves comparing the level of risk determined during the analysis process with an established risk criteria.

**Methods**

**METHOD PROPERTIES**

**COMPLEXITY**

The application complexity and skills the method demands for the successful usage and application. High complex methods could deliver accurate outcomes and less subjectiveness compared to the less complex methods.

**Methods**

**EFFORT**

The resources and time effort required to gather all important data for the successful application of the corresponding method. Several methods require more input, which increases the required effort.

**Methods**

**METHOD TYPE**

Qualitative methods are more subjective but simpler than quantitative methods. Quantitative methods are more resource intensive. Semi-quantitative methods combine the qualitative and quantitative assessment aspects.

**Methods**

<https://hazard.logu.tuhh.de>

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**Conclusion and outlook**

# Conclusion and Outlook

- Risk management in seaports has a strong focus on safety issues, dangerous goods and natural disasters
- Checklists are frequently used in the phase of risk assessment across all type of organizations.
- Experience of individual employees and authorities plays a central role in the process of risk assessment.
- Complex stakeholder structure in seaports is a big challenge for an overall risk management approach

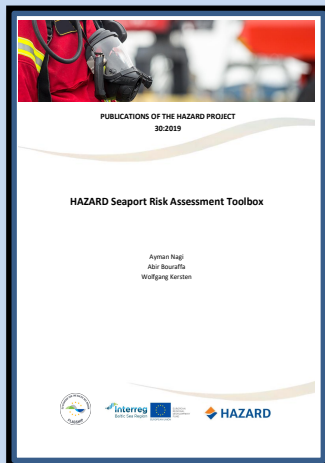
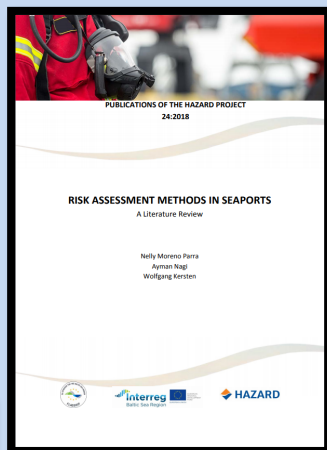


**A comprehensive stakeholder map, clear assignment of risk and process owners and the use of advanced risk management methods (e.g. HAZARD risk assessment toolbox) can make a contribution to further improvement of risk management in seaports.**

 **Final remark:**  
Many insights from the HAZARD project as well as from the HAZARD risk assessment toolbox are not only relevant for seaports but also for many companies with regard to **improving supply chain risk management in general!**

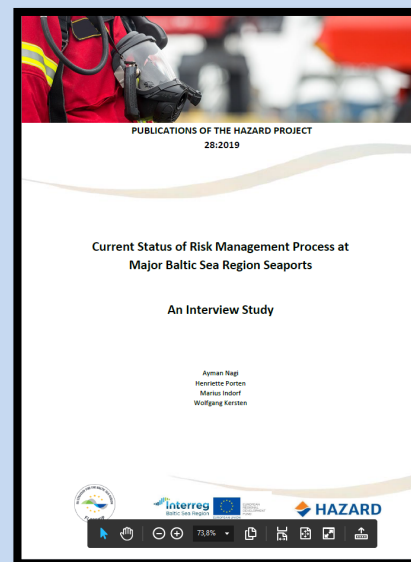
# Further readings

## Risk Assessment Methods in Seaports



## HAZARD Seaport Risk Assessment Toolbox

## Current Status of Risk Management Process at Major Baltic Sea region Seaports



These HAZARD reports and much more publications can be downloaded from <https://blogit.utu.fi/hazard/publications/>

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