HAZARD Seaport Risk Assessment Toolbox

User Guide

Version 1.3

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1 HAZARD SEAPORT RISK ASSESSMENT TOOLBOX

The online Toolbox is available as a website and accessible for all potential users. The main functionality of the Toolbox is to guide and inform the users through the process of choosing an appropriate risk assessment method based on their specific needs and the type of risk they are facing.

The Toolbox has been designed with simplicity in mind. This is mirrored in the structure chosen arranging and presenting the information in question. This structure is depicted in **Figure 1**.

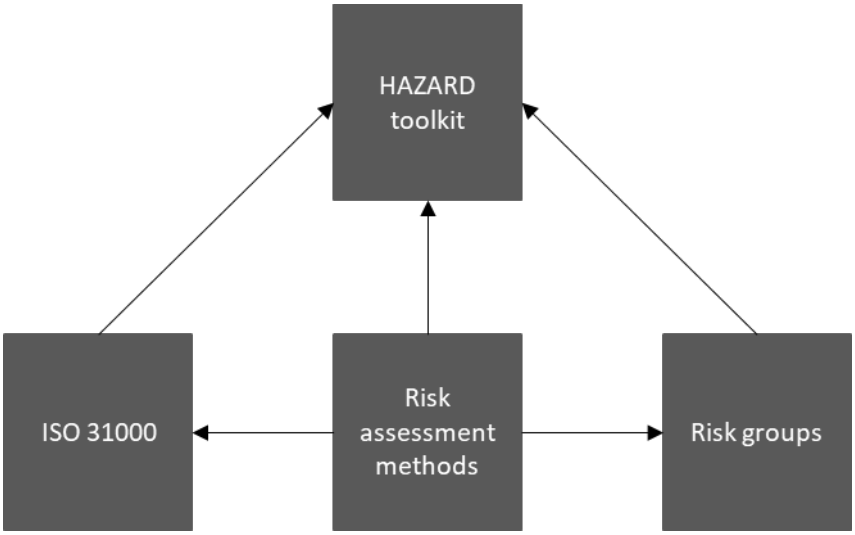


Figure 1: *General structure of the HAZARD Seaport Risk Assessment Toolbox*

1.1 ISO 31000 section of the Toolbox

This section offers a concise introduction to the ISO 31000:2018 standard describing the most recent risk management guidelines.

a. *Principles*
   Outlines the set of principles an organisation should comply with to meet the standard. An example hereof is the continuous improvement of risk management within an organisation
b. *Framework*
   The framework offers the foundations and crucial steps towards implementing an effective risk management process within an organisation
c. *Process*
   The process describes the actual steps included in the ISO 31000 guideline. These include three phases constituting the main focus of the Toolbox: Risk Identification, Risk Analysis and Risk Evaluation. The risk assessment methods described in the following section are sorted according to their usefulness in these three steps of the risk assessment process.

1.2 Risk assessment methods section of the Toolbox

As mentioned previously, the Toolbox offers a catalogue of risk assessment methods gathered from academic literature and consolidated with qualitative analysis of the status quo in practice. To make it easier for the user to navigate the so-described catalogue, the Toolbox offers a categorisation by the following related factors:

a. *ISO 31000 Step:*
   As mentioned in the previous section, each risk assessment method is assigned to one or more of the ISO Steps: Risk Identification, Risk Analysis and Risk Evaluation with varying levels of granularity. This assignment expresses that the method in question can be applied in the corresponding ISO 31000 step.

b. *Method properties*
   Additionally, it is possible to filter the risk assessment methods by the following descriptive properties:

1. <u>Complexity</u>
   The application complexity and skills the method demands for the successful usage and application. High complex methods could deliver accurate outcomes and less subjectivity compared to less complex methods.

2. <u>Effort</u>
   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.

3. <u>Method Type</u>
   According to academic literature, risk assessment methods fall into three categories defined as:
   a. *Qualitative*
      Based solely on the outcome of human interactions and the communication of expert knowledge through natural language by conducting interviews, surveys etc.
   b. *Quantitative*
      Based solely on numerical data analysis and formal or mathematical models
   c. *Semi-Quantitative*
      A hybrid approach of the previous method types capturing the strengths of both, mainly offering the opportunity to assert the formal models with experience reports

1.3 Risk groups section of the Toolbox

In addition to the catalogue of risk assessment methods, the Toolbox offers a hierarchical definition of the most commonly encountered risk types. The hierarchy is defined in the following:

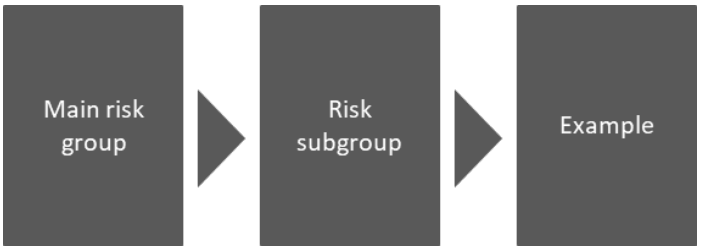


Figure 2: *Breakdown structure of the risk groups*

The hierarchy (shown in **Figure 2**) is organised in a way such that the upper most elements are generic risk groups, which get more and more specific in the subgroups. The last layer of the so-constructed risk tree are most concrete examples of potential risks. These elements are linked directly to the assessment methods addressing them to ensure maximum level of detail and orientation towards the user's risk situation.

1.4 HAZARD Toolkit section

The HAZARD toolkit is the main component of the web-tool. It is mainly organised as a layered form, which needs to be filled by the user to narrow down the risk assessment methods based on the selected criteria. These criteria are geared towards the user needs in terms of required effort, complexity and type of method as well as the risk he/she is attempting to address.

The form contains the following steps:

1. Risk Groups:
   At this level, the user may choose one or more elements of the highest level in risk type hierarchy that is of interest.

2. Risk Subgroups:
   At this level, the user may choose one or more elements of the second level of the risk type hierarchy that is of interest.

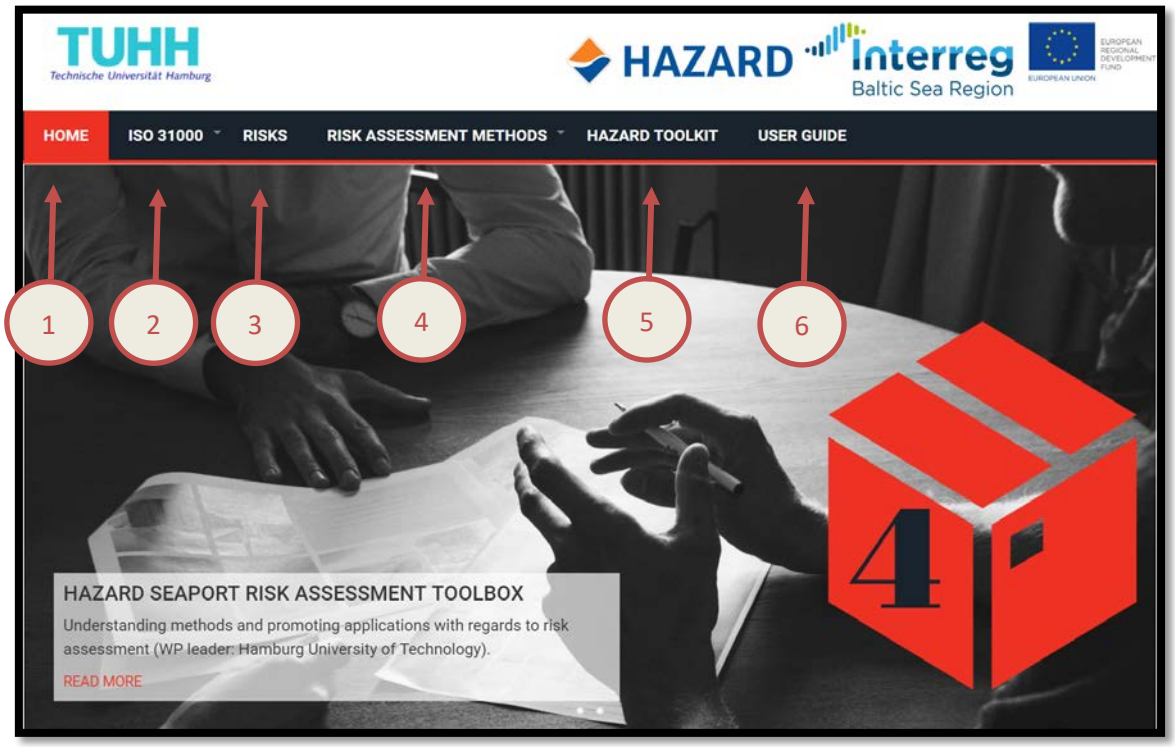
3. Risks:
   At this level, the user may choose one or more concrete risks based on the previous two steps.

4. Method Properties:
   This step permits the user to narrow down their search domain of risk assessment methods based on their needs in terms of complexity, effort and methodology they are most comfortable adopting.

5. Output:
   The output of the Toolbox is a list of risk assessment methods tailored to the previously chosen criteria. The output only shows the procedural steps defined by the method for risk assessment as well as a file attachment(s) of useful resources.

2 USER MANUAL OF THE HAZARD SEAPORT RISK ASSESSMENT TOOLBOX

The user manual gives the user a step-per-step instruction on how to use the Toolbox based on actual screenshots from the website. The website is available through the link https://hazard.logu.tuhh.de.

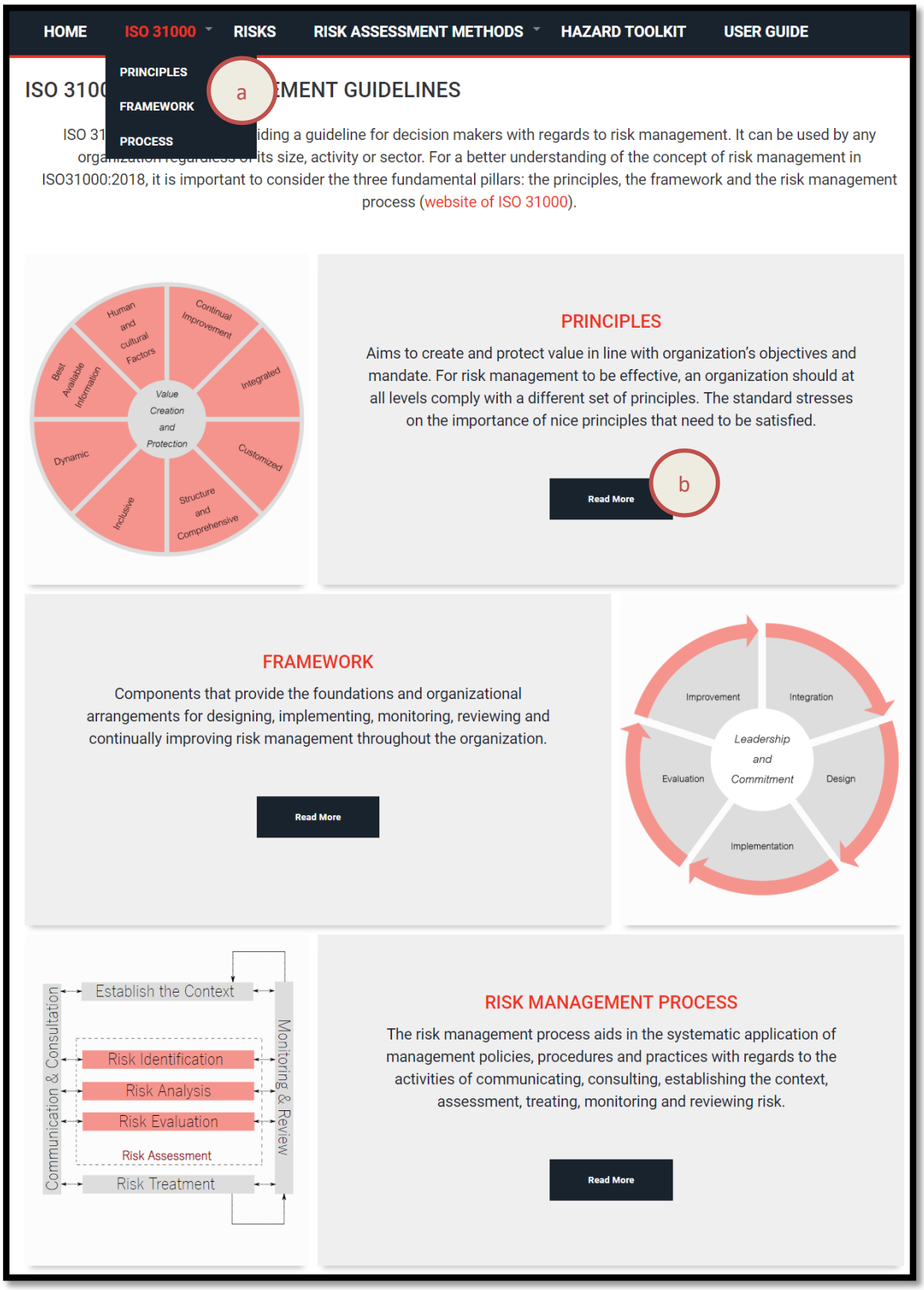


1 **Project Description:**

The welcome page of the HAZARD tool offers a short introduction of the HAZARD Project and its scope. Furthermore, it defines the tasks agreed upon and to be delivered by Work package 4, of which the Toolbox represents a crucial part.

2 **ISO 31000:**

The second menu tab in the main navigation offers a short overview of the different components defined in the ISO 31000 standard. These can be accessed either directly through the dropdown menu a or by clicking on the *Read More* button b in the corresponding section.



For example, by clicking on *Principles*, one is redirected to a webpage with further details about this construct:

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PRINCIPLES

PRINCIPLES

The principles aim to create and protect value in line with the organization's objectives and mandate. For risk management to be effective, an organization should at all levels comply with different set of principles. The standard stresses on the importance of eight principles that need to be satisfied as follow:

INTEGRATED

Risk management should be integrated into the main activities and processes of the organization. It is not a stand-alone activity, and should be part of the management's responsibilities and an integral part of all organizational processes, including strategic planning and all project and change management processes.

CUSTOMIZED

The organization's internal and external context, as well as risk profile, should be considered in the design and implementation of risk management. Based on the scope, goals and context of the organization, risk management can be customized accordingly.

STRUCTURED AND COMPREHENSIVE

The efficiency to deliver consistent, comparable and reliable results depends on a structured, systematic and timely approach to risk management. The approach should display the developed steps, dependencies, and the associated flows.

INCLUSIVE

Ensuring a relevant and up-to-date risk management should be based on timely and appropriate involvement of stakeholders and decision makers at all levels of the organization. This allows the proper representation of stakeholders by taking their views into consideration in determining risk criteria.

DYNAMIC

The dynamic aspect of risk management requires continuous sense and responses to changes. As internal and external events occur, knowledge and context change, review and monitoring of risks take place. This can result in the emergence of new risks, change and/or disappearance of others.

BASED ON BEST AVAILABLE INFORMATION

The proper management of risks requires accurate input that are based on information sources such as observations, historical data, expert judgment, and observation. However, the stakeholders and decision-makers should take into account any limitations of the models and data used in the management of risks.

CONSIDERATION OF HUMAN AND CULTURAL FACTORS

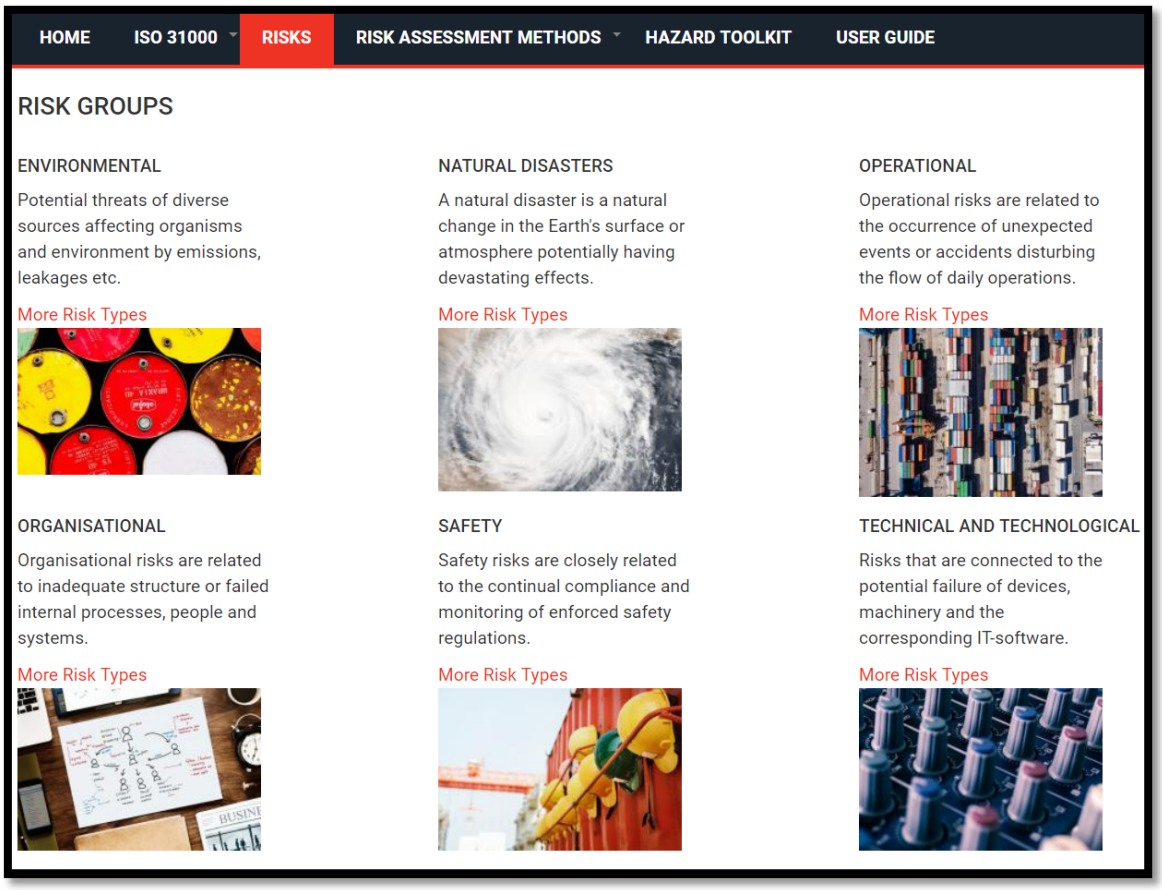
The intention, capabilities, and perceptions of internal and external people should be recognized by risk management which can hinder or facilitate the fulfillment of the organization's objectives.

CONTINUOUSLY IMPROVED

Organizations should design and implement strategies an measures in order to improve the risk management maturity in parallel to all other aspects of their organization. These development and implementation strategis should fulfill the requirnments of core stakeholders.

3 Risk Groups:

Under the Risks tab, the user can get an overview of the existing risk groups. By clicking on *More Risk Types*, one can navigate the risk hierarchy form the generic types such as Natural Disasters all the way down to concrete risk types such as floods.

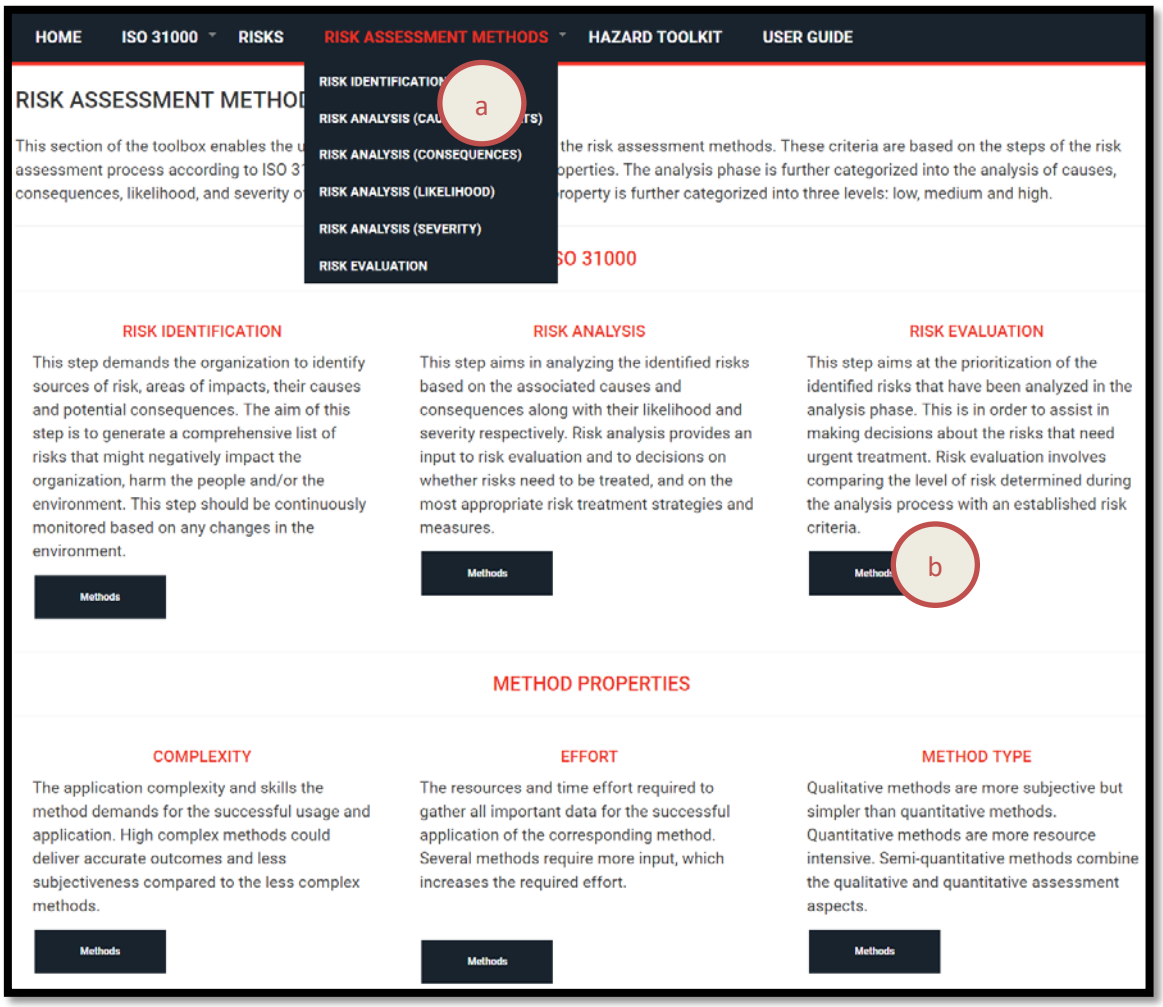


4 Risk Assessment Methods:

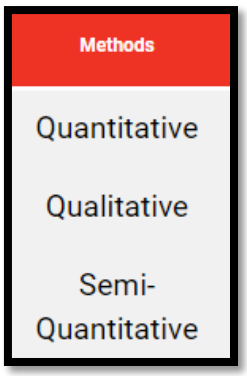
The risk assessment methods menu can be accessed through the fourth tab in the main navigation.

As it is clear from the following screenshot, this page offers a compact representation of risk assessment methods filtered by the phase of the risk assessment process: Risk Identification, Risk Analysis, Risk Evaluation and the method properties: Time required, complexity and method type.

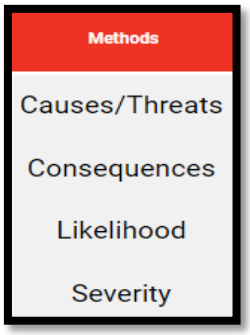
Here again, the filtered view of the methods can either be accessed either through the drop-down menu a or by clicking on the *Methods* b button.



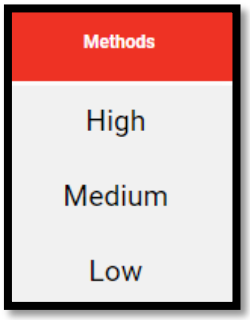
The buttons are sub-divided as to offer a granular filtering of the methods. For example, when hovering over the button under methods type, further filtering options appear:



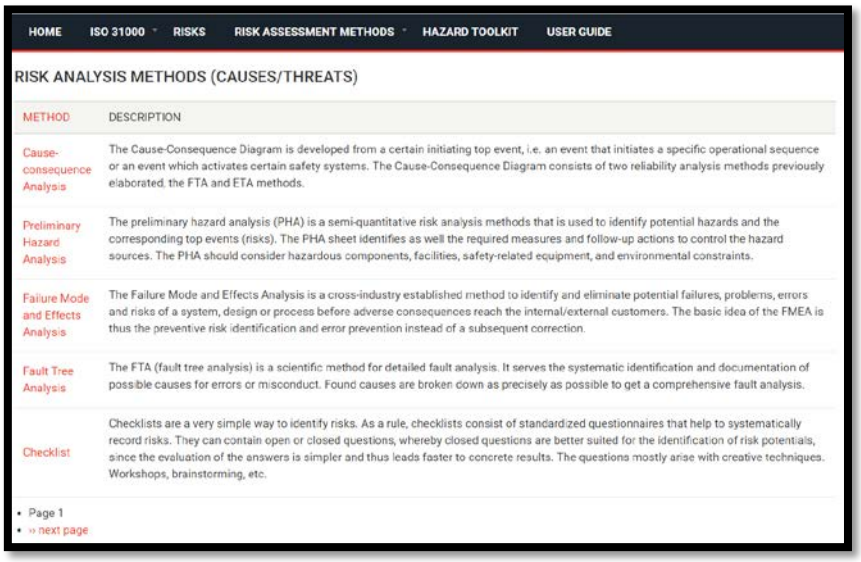
The methods under risk analysis are further subdivided into the following risk analysis categories:



For the rest of the method properties, following options are made available:



For example, when choosing the methods for risk analysis for causes and threats, one gets redirected to a summary table displaying all methods falling under these categories:



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RISK ANALYSIS METHODS (CAUSES/THREATS)

METHOD	DESCRIPTION
Cause-consequence Analysis	The Cause-Consequence Diagram is developed from a certain initiating top event, i.e. an event that initiates a specific operational sequence or an event which activates certain safety systems. The Cause-Consequence Diagram consists of two reliability analysis methods previously elaborated, the FTA and ETA methods.
Preliminary Hazard Analysis	The preliminary hazard analysis (PHA) is a semi-quantitative risk analysis methods that is used to identify potential hazards and the corresponding top events (risks). The PHA sheet identifies as well the required measures and follow-up actions to control the hazard sources. The PHA should consider hazardous components, facilities, safety-related equipment, and environmental constraints.
Failure Mode and Effects Analysis	The Failure Mode and Effects Analysis is a cross-industry established method to identify and eliminate potential failures, problems, errors and risks of a system, design or process before adverse consequences reach the internal/external customers. The basic idea of the FMEA is thus the preventive risk identification and error prevention instead of a subsequent correction.
Fault Tree Analysis	The FTA (fault tree analysis) is a scientific method for detailed fault analysis. It serves the systematic identification and documentation of possible causes for errors or misconduct. Found causes are broken down as precisely as possible to get a comprehensive fault analysis.
Checklist	Checklists are a very simple way to identify risks. As a rule, checklists consist of standardized questionnaires that help to systematically record risks. They can contain open or closed questions, whereby closed questions are better suited for the identification of risk potentials, since the evaluation of the answers is simpler and thus leads faster to concrete results. The questions mostly arise with creative techniques. Workshops, brainstorming, etc.

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When clicking on one of the proposed methods, for example the *Cause-Consequence Analysis*, the corresponding method card is displayed.

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CAUSE-CONSEQUENCE ANALYSIS

DESCRIPTION

The Cause-Consequence Diagram is developed from a certain initiating top event, i.e. an event that initiates a specific operational sequence or an event which activates certain safety systems. The Cause-Consequence Diagram consists of two reliability analysis methods previously elaborated, the FTA and ETA methods. 1

ISO 31000

Risk Analysis - Causes/Threats

Risk Analysis - Consequences

Risk Analysis - Likelihood

Risk Analysis - Severity

2

COMPLEXITY

High

3

METHOD TYPE

Quantitative

Semi-Quantitative

4

EFFORT

High

5

PREREQUISITES

- System or process descriptions must be available
- Documentation that can already provide information on the causes and consequences of failures should be available

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RELATED RISKS

Transportation of Toxic Materials

Use of Corrosive Chemicals

Oil Leakages and Spills

Storage and Transportation of Dangerous Goods

Undeclared Dangerous Goods

7

BASIC APPROACH

1. carrying out a system analysis, i.e. close examination of the system and its interfaces
2. definition of undesired events (errors)
3. determination of consequences
4. determination of the causes and failure probabilities if possible

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ADVANTAGES

- Systematic presentation of the causes and consequences
- Measures for risk minimization can be derived
- Very comprehensive risk analysis

9

DISADVANTAGES

- Training is necessary before the first execution
- The availability of resources must be guaranteed

10

PDF 11

Cause-consequence Analysis.pdf

RELATED LITERATURE

Andrews, J.D. and Ridley, L.M., 2002. Application of the cause–consequence diagram method to static systems. Reliability Engineering & System Safety, 75(1), pp.47-58.

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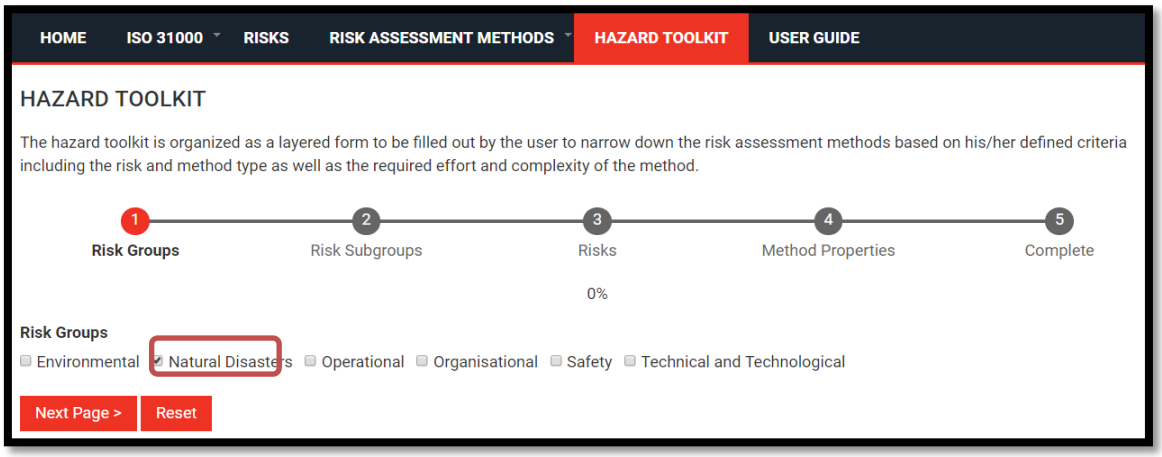
The method card contains all-important information about the risk assessment method including:

1. A short description
2. The ISO 31000 step(s) the method is adequate for
3. Complexity
4. Method type
5. Effort
6. Prerequisites
7. Related (linked) risks
8. The basic approach to follow
9. Advantages of using the method
10. Disadvantages of using the method
11. Useful attachments: Method card in pdf format, etc.
12. Related literature sources

5 HAZARD Toolkit

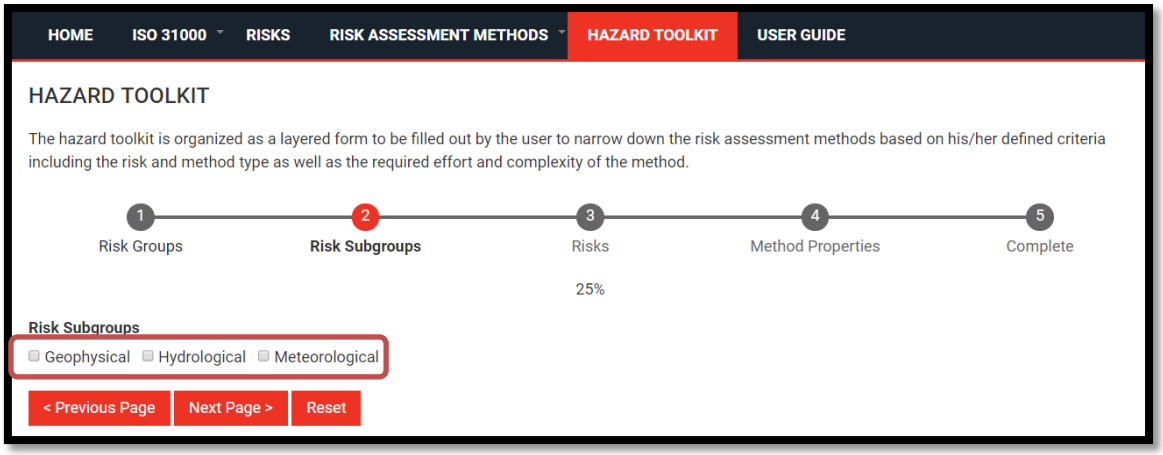
The first step of the HAZARD Toolkit permits the user to choose from the list of uppermost elements of the risk hierarchy. In other words, the user may choose which groups of risks he/she is interested in from the following list:

- Environmental
- Natural Disasters
- Operational
- Organisational
- Safety
- Technical and Technological

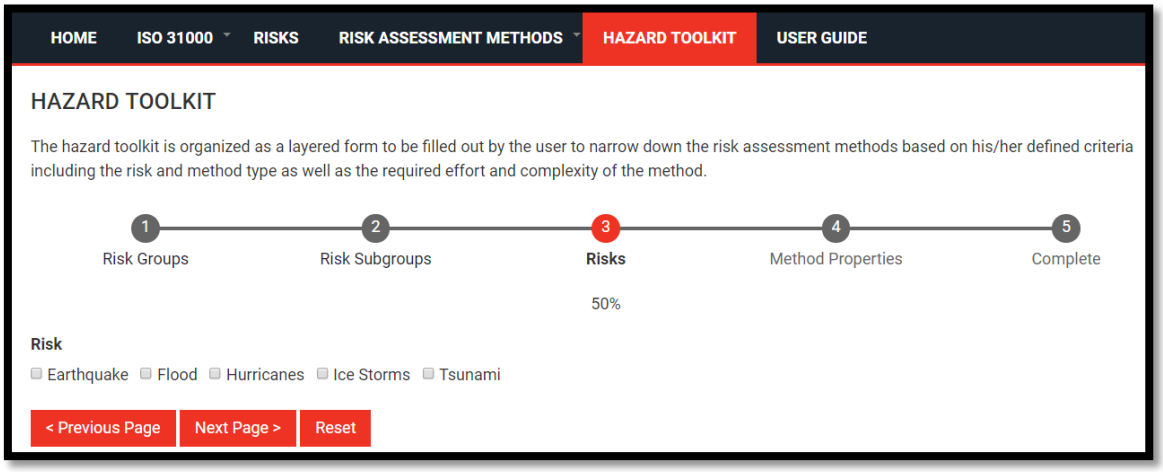


In the next step (after clicking on *Next Page*), the user is prompted to choose from the subgroups of risks based on his/her choice in the previous step, in order to further reduce the search area.

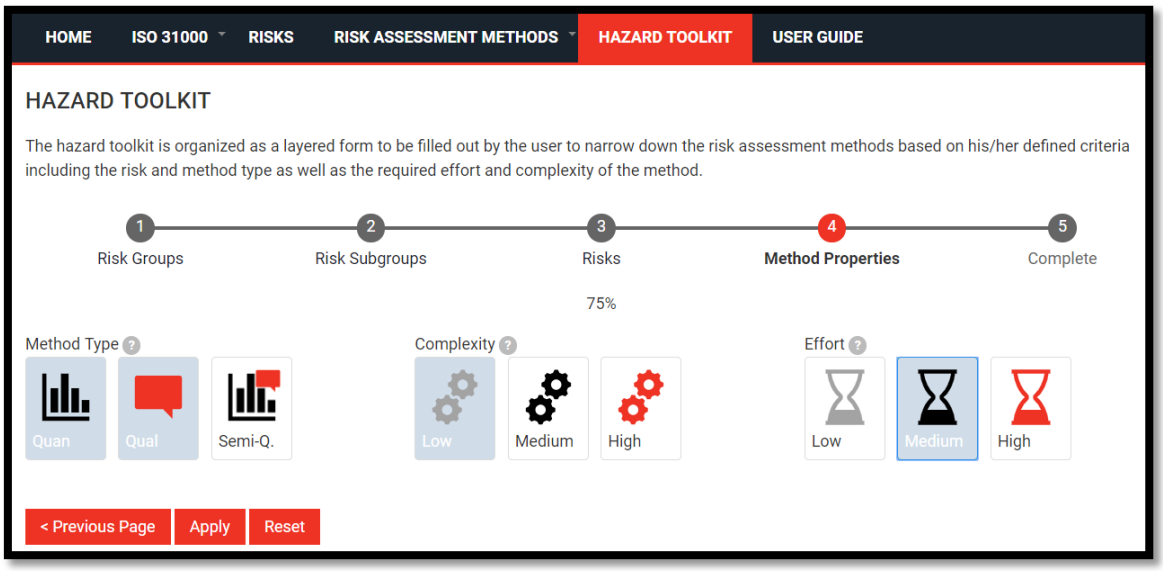
For example, if the user chose *Natural Disasters* in the previous step, then the corresponding subgroups *Metrological*, *Hydrological* and *Geophysical* will appear in the Risk Subgroup Step as shown below:



After choosing the risk subgroups on the *Risk Subgroup* page and clicking on *Next Page*, a new page opens displaying the concrete/specific risks belonging to the previously chosen subgroups. These risks describe situational hazards that may occur in practice in a harbour setting. The user may again choose one or multiple risks that they would like to assess.



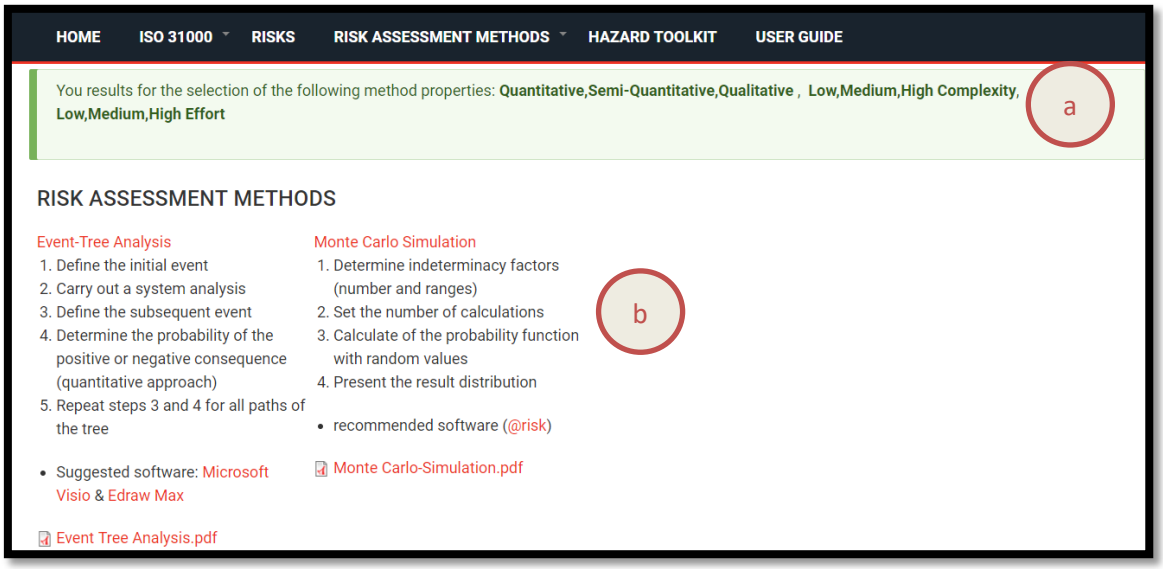
The last step of the HAZARD Toolkit is a menu page offering the possibility to determine the properties of the risk assessment methods that are relevant for the user. Here, it is possible to choose the method type, the effort and the desired complexity. For both effort and complexity, a simple scale with the values high, medium and low, is used. It is possible to choose more than one value per property. For the method type, one can choose between quantitative, qualitative and semi-quantitative methods. Here again more than one value can be selected.



Once the user has made her/his choice of the desired method properties, the user can then proceed and click on *Apply* to access the output of the Toolkit. An example hereof is given in the following figure.

The message in the green box in a gives a reminder for the user, which method properties have been chosen.

The actual output is given in b. Here a list of one or more risk assessment methods is given, which are filtered following the criteria the user entered throughout the Toolkit steps. For each method, only the steps of its basic approach are laid out, to avoid overloading the user with unnecessary information. The complete method card can still be accessed by clicking on the method title, which is defined as a hyperlink.



HAZARD project has 15 full Partners and a total budget of 4.3 million euros. It is executed from spring 2016 till spring 2019, and is part-funded by EU's Baltic Sea Region Interreg programme.

HAZARD aims at mitigating the effects of major accidents and emergencies in major multimodal seaports in the Baltic Sea Region, all handling large volumes of cargo and/or passengers.

Port facilities are often located close to residential areas, thus potentially exposing a large number of people to the consequences of accidents. The HAZARD project deals with these concerns by bringing together Rescue Services, other authorities, logistics operators and established knowledge partners.

HAZARD enables better preparedness, coordination and communication, more efficient actions to reduce damages and loss of life in emergencies, and handling of post-emergency situations by making a number of improvements.

These include harmonization and implementation of safety and security standards and regulations, communication between key actors, the use of risk analysis methods and adoption of new technologies.

See more at: http://blogit.utu.fi/hazard/