



# RISK MANAGEMENT MODELS: CONCEPTS AND PARAMETERS

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# INTRODUCTION

Communities are dependent on mass distribution of information, goods, and services. Influencing the welfare, security, and economy of every country subject to the performance of its infrastructures. This situation demonstrates the importance of Critical Infrastructures (CI), as they facilitate society's functions and services.



Source: <https://www.dw.com/es/inundaciones-en-alemania-antes-y-después-en-las-regiones-de-ahr-y-eifel/a-58303135>



Source: <https://www.ft.com/content/d8749a56-b33e-11e7-aa26-bb002965bce8>



# DEFINITION OF RISK

Risk is the result of the probability of occurrence multiplied by the consequences of the event

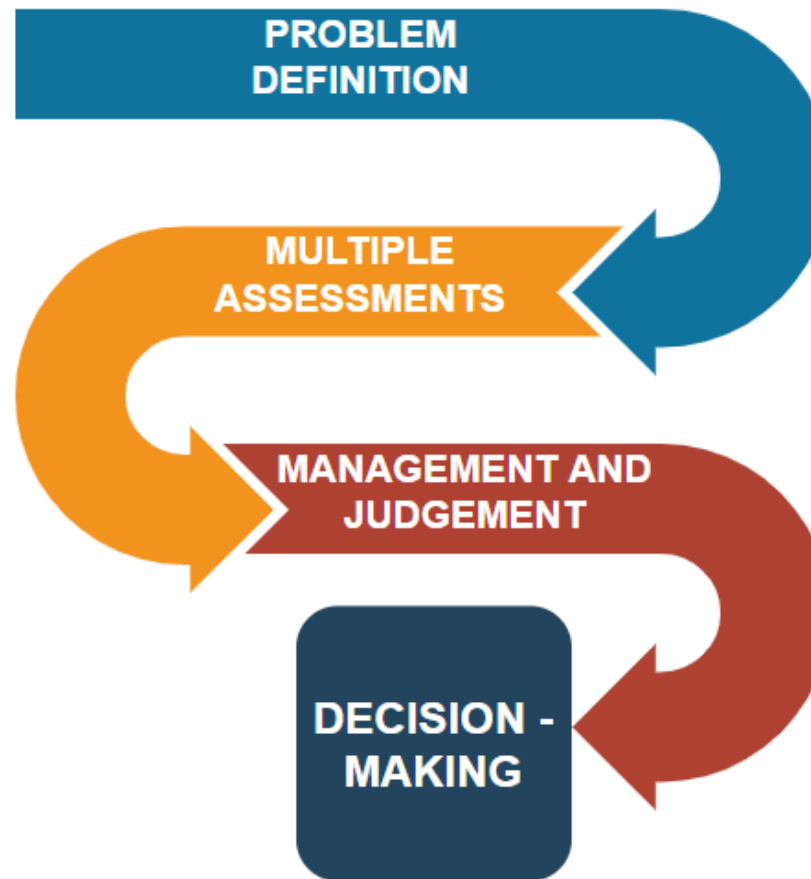
$$R = \sum_{i=1}^N P_i \times C_i$$



Source: <https://www.bomca-eu.org/en/news/125-central-asian-customs-are-reforming-their-risks-management-systems-2>

# RISK MANAGEMENT AND DECISION-MAKING

Systematic application of management policies, procedures and practices for assessing, controlling, communicating, and reviewing a risk.



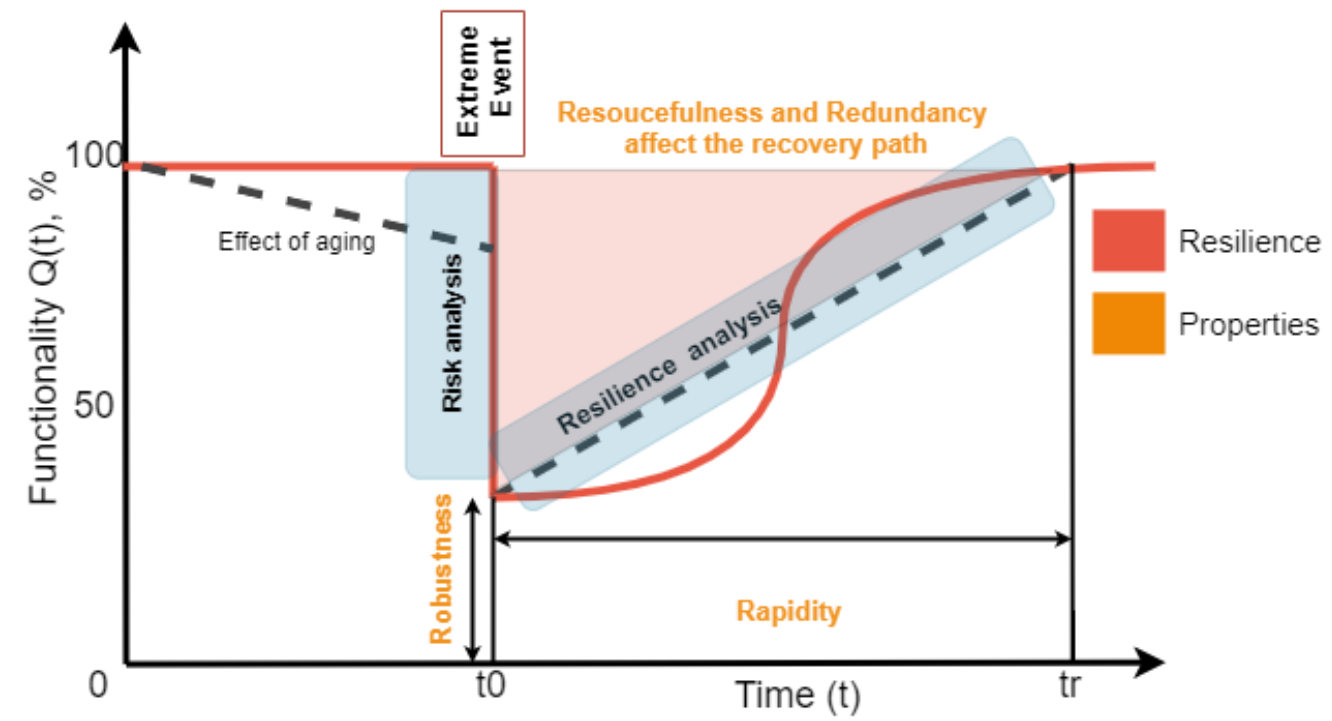
# RISK ASSESSMENT



According to the international standard ISO 31000:2009 and the EUR 28034 EN and EUR 30183 reports from the Joint Research Center (JRC)

# RESILIENCE ASSESSMENT

“The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management” United Nations Office for Disaster Risk Reduction (UNDRR).

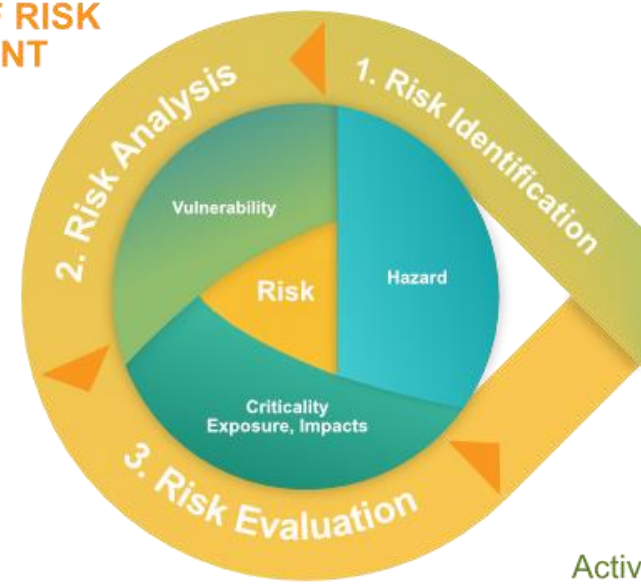




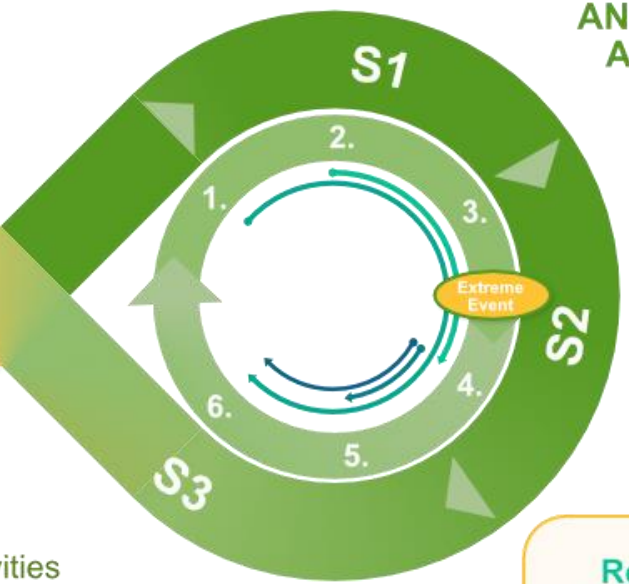
# RISK AND RESILIENCE ASSESSMENT

## THE SYNERGY BETWEEN RISK AND RESILIENCE

### CYCLE AND ELEMENTS OF RISK ASSESSMENT



### RISK MANAGEMENT AND RESILIENCE ASSESSMENT



**S1: Adaptation**  
**S2: Absorption**  
**S3: Recovery**

Properties

**Redundancy (2-4)**  
**Resourcefulness (1-6)**  
**Robustness (4-5)**  
**Rapidity (4-6)**

Activities

1. Risk assessment
2. Prevention, adaption and mitigation
3. Preparedness
4. Response
5. Damage assessment
6. Recovery, rehabilitation and restoration

# EXAMPLES OF RISK MANAGEMENT MODELS

Methodology	Type of risk	Necessary parameters to insert (inputs)	Parameters obtained (outputs)	Focus of the study
<b>Dynamic Inoperability Input-Output Model (DIIM).</b>	Natural disasters: hurricanes	-Inputs of hazard information, types of structure, fragility curves, minimum operability requirements, dependency matrix and weights for all systems are required. -Loss ratio.	-coefficients of recovery and operability for different types of infrastructure against extreme events.	Evaluates the recovery of civil infrastructure facilities, considering the dependencies at the infrastructure level.
<b>GIS-Based High-level Approach.</b>	Coastal floods and erosion, River and Rain floods, Bridge runoff, Extreme storms, Cold, Heat and Landslides	Change in mean seasonal precipitation; -Change in maximum daily seasonal temperature and number of consecutive dry days; -Number of ice and frost days; -Number of extreme wind speeds; -Number of very wet days; -Precipitation intensity and number of very wet days; -Number of very wet days and seasonal variation in precipitation.	-sector information matrices highlighting the main links between infrastructure assets and climate threats. -sector letters showing the exposure of current and future plots of vulnerable CI networks. -maps for classifying cross-cutting geo-sectoral risks to the various climate threats.	Aims to provide decision-makers with the information they need to make their decisions on the potential impacts and opportunities of climate change and highlights the critical points of climate change for more detailed analysis.

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<b>Damage Estimation Model (DEM) and Infrastructure Disruption Model (IDM).</b>	Hurricanes	<ul style="list-style-type: none"> <li>-wind speed</li> <li>-radio to maximum wind</li> <li>-storm track</li> <li>-maximum wind speed in the region for the chosen hurricane scenario</li> <li>-infrastructure components and the interdependencies under study</li> </ul>	It provides three wind damage maps and the flood damage map, including a list of all nodes (components of the Infrastructure studied), whether they have been damaged (from damage estimate model), and types of interruptions are occurring.	Analysis of hurricanes to estimate the CIs damage and service disruptions. Study how a community is affected by the CI interdependencies and prepare it against extreme events.
<b>The Safe City.</b>	Natural disasters and terrorist attacks	<ul style="list-style-type: none"> <li>-Digital City Terrain Model and layers representing existing water bodies;</li> <li>-Other parameters must be defined by the end user individually for each analysis performed. These include the amount by which the simulated water level is increased over its default value and the extent of the area for which the simulation will be performed.</li> </ul>	The creation of hazard scenarios during the Preparedness phase, mapping of threats identified in the Response phase, and the simulation of the geographic impact of threats during the Mitigation phase.	It presents a municipal CI analysis system, that offers integrated tools for target analysis, risk scenario simulations and spatial analysis within a web-based and remotely accessible Geographic Information System.

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**GRACIAS**

**THANK YOU**



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