# IMPROVED RISK EVALUATION AND IMPLEMENTATION OF RESILIENCE CONCEPTS TO CRITICAL INFRASTRUCTURE

CRITIS 2017

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**CRITIS**
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# Paradigm shift: from protection to resilience

- Protection has been deemed impossible for unexpected events, too costly as well as potentially leading to a false sense of security

- Resilience:
  - "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" - UNISDR


- Resilience is really nothing new
  - There is a strong desire to incorporate existing methods and information, without overloading operators with new analysis techniques

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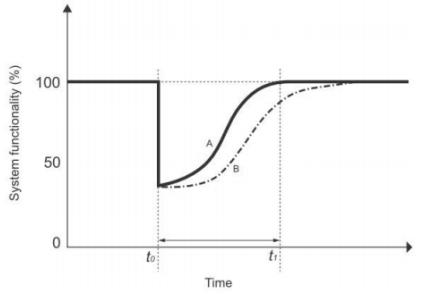
# IMPROVER: objectives

- Understand the definition of resilience




- Understand how this can be measured

- Help operators to measure, evaluate and improve the resilience of their infrastructure **via a framework**

- **With the ultimate goal of maintaining the ability of systems to continue to provide the service required**

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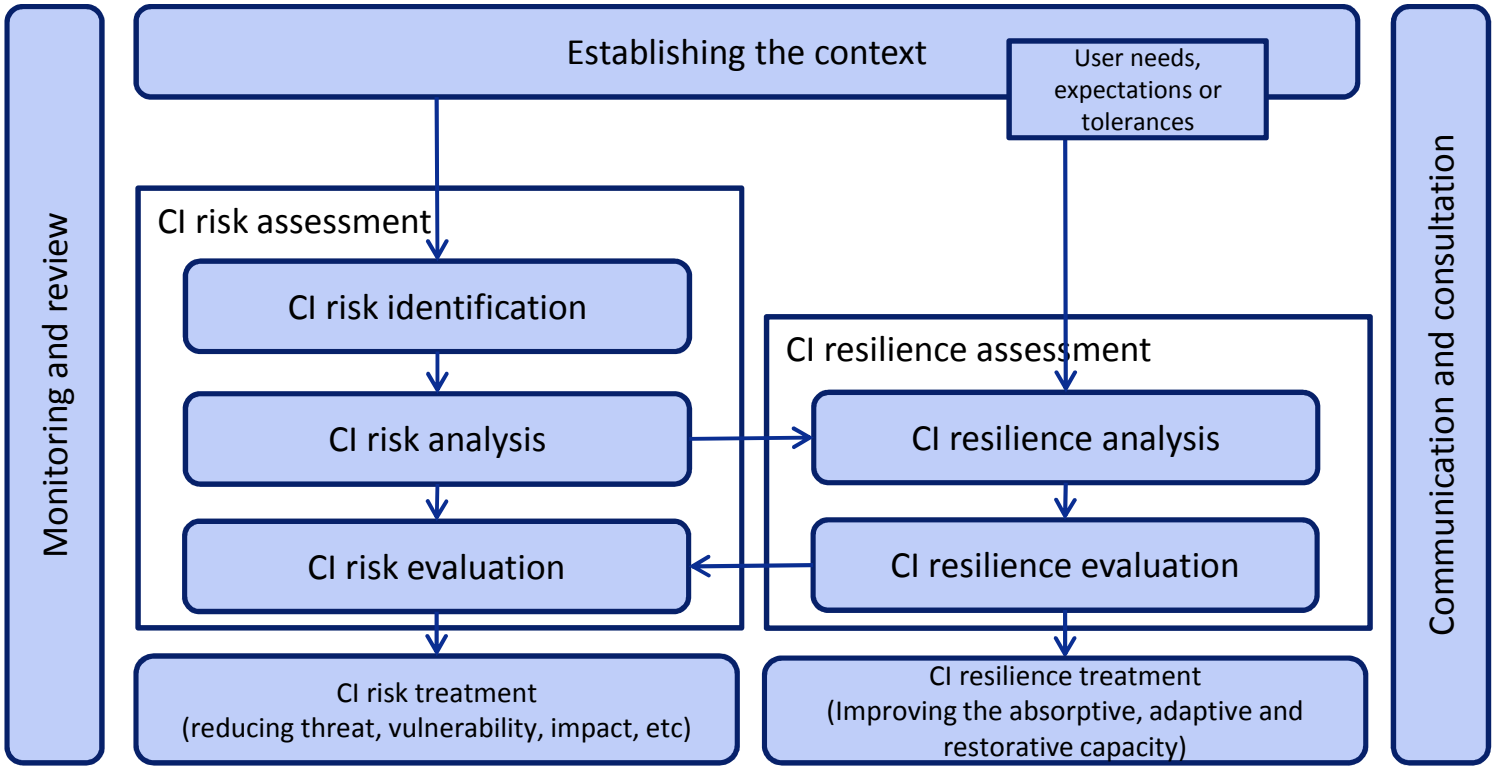
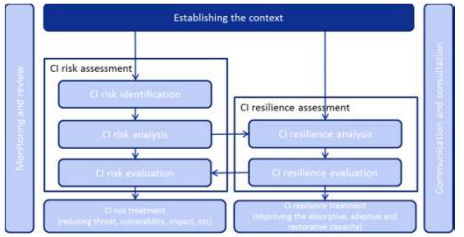
# The IMPROVER Framework

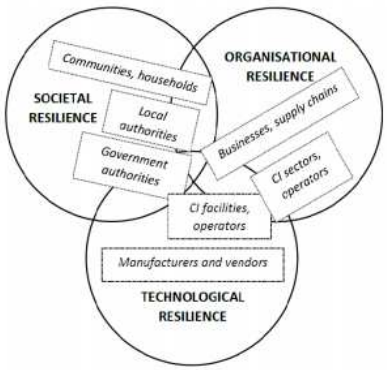


# Establishing the context (1/2)

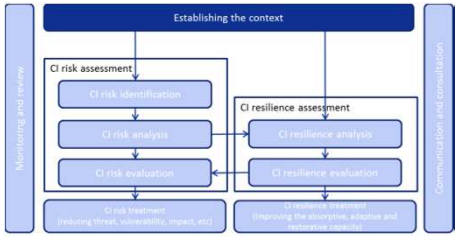



Establishing the context

- Systems identification
- Determine resilience domains of the analysis
- Set system boundaries
- Outline structural components
- Set performance measures
- Criteria for risk and resilience evaluation
- Existing methods and approaches for risk and resilience assessment



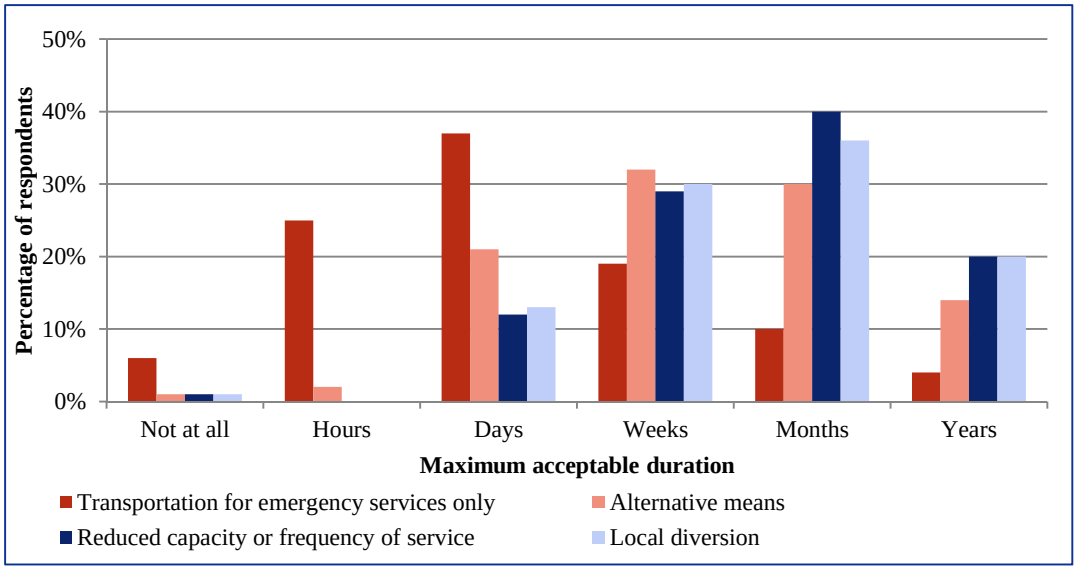
# Establishing the context (2/2)




Establishing the context

User needs, expectations or tolerances

- Guideline for developing these surveys for other sectors

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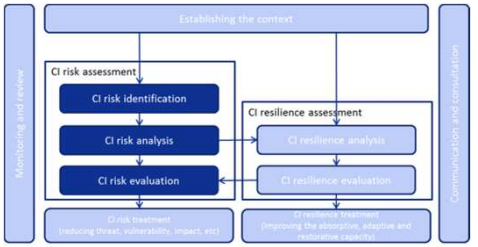
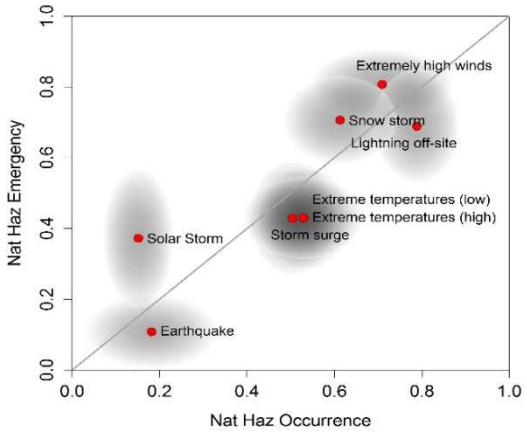
# CI risk assessment

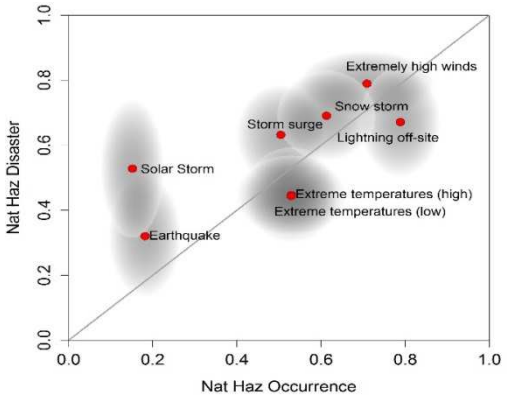



Best practices, operator risk assessments, national risk assessments, sector specific guidelines and methods

CI risk assessment

- CI risk identification
- CI risk analysis
- CI risk evaluation

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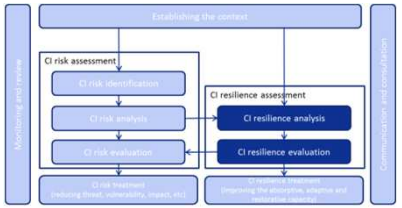
# CI resilience assessment

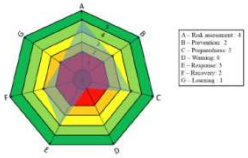



CI resilience assessment

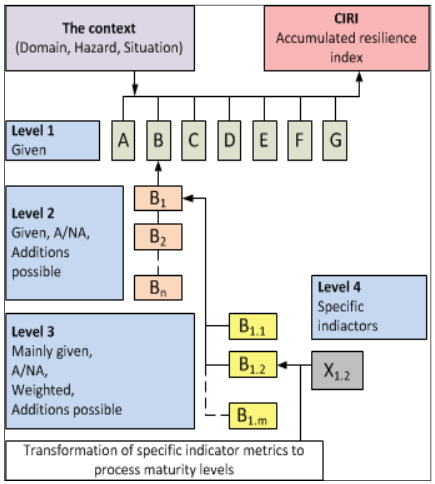
CI resilience analysis

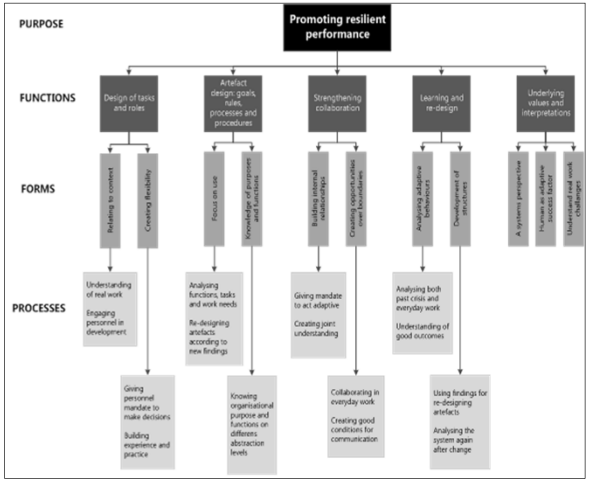
CI resilience evaluation

- Other similar organisations
- The same organisation over time
- The performance with user expectations

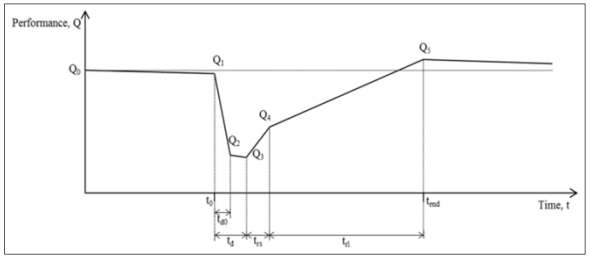


- IMPROVER methodologies:

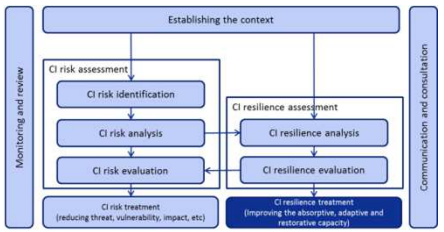


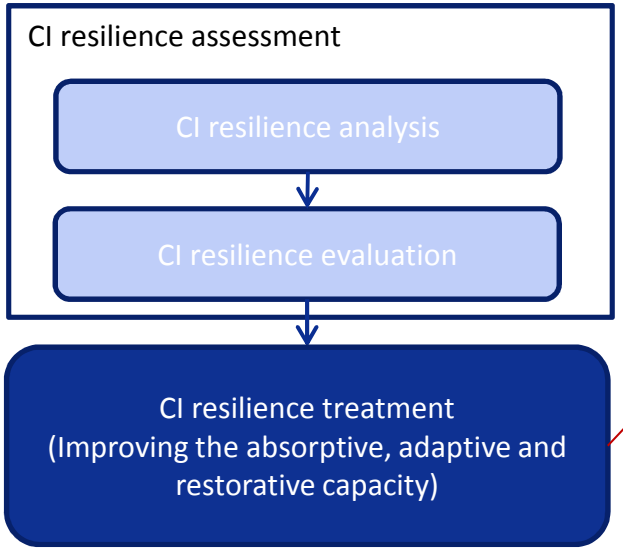




$$R_{T_{con}} = \int_{t_0}^{t_0+t_{ref}} Qdt$$



# CI resilience treatment




- Detailed statement of:
  - Technological resilience: which of the absorptive, adaptive, restorative capacities the system under study is deficient in
  - Organisational resilience: which organisational process(es) need(s) to be improved
  - Across multi-domains: which resilience indicators need to be improved

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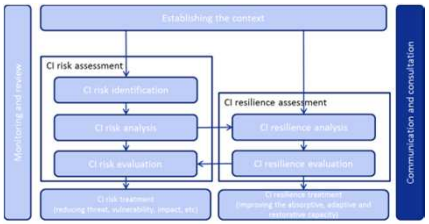
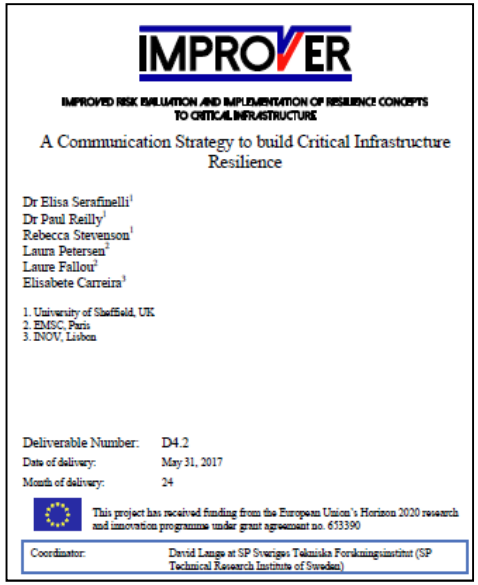
# Communication and consultation




Communication and consultation

- CI communication guidelines
  - managing expectations
  - promoting engagement with the public



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A Communication Strategy to build Critical Infrastructure Resilience

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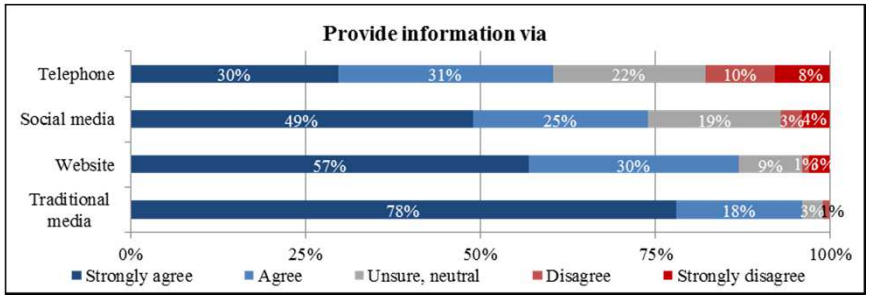


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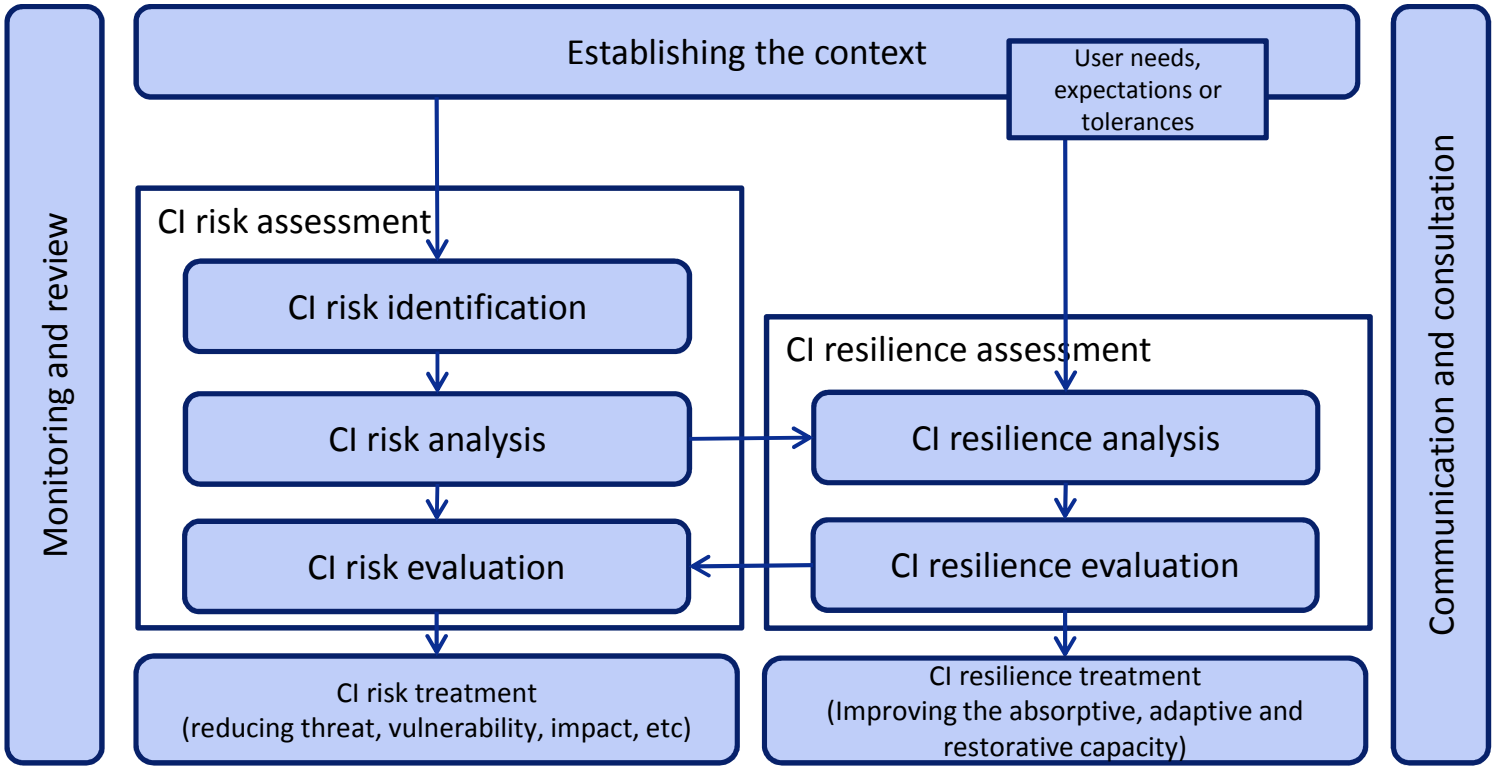
# The IMPROVER Framework



# Testing the IMPROVER framework: Pilot Implementations

- 5 living labs:
  - Municipality of Barreiro
  - French A31 highway
  - Budapest M1 Highway
  - Port of Oslo
  - The Oresund Region

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# Highlights and ongoing work

- To operationalise resilience, needs to be integrated into existing security activities
  - Enriches risk assessments with information about the resilience of critical infrastructure

- We propose
  - A generic framework for the integration of resilience management into risk management
  - 4 methodologies for resilience analysis

- Pilot implementation of the framework
  - Using various analysis and evaluation methodologies
  - Applied to the municipality of Barreiro and the ring road around Budapest

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# Thank you!

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