Resilience Management Guidelines for Critical Infrastructures.
From theory to practice by engaging end-users: concepts, interventions, tools and methods

Based on white paper and event prepared by all DRS-7 projects,
Presented by Dr. Ivonne Herrera DARWIN (SINTEF)
Conclusion

• Bringing theory closer to practice

• A nice set of complementary tools

• Bricks to enhance resilience to adapt to current and future shocks and stresses

• Validated them in several pilot implementation and they have worked out

• Still have some work to do it on integrating these tools in a meaningful way
Achievements

- Different sets of resilience management guidelines developed by each of the projects
- Complementary resilience assessment tools and methods
- Resilience implementation and training activities
- **Advances on conceptual maturity**
- Work towards standardisation
- Integration and further validation work is needed

Concepts and methods to their relevant scope and domain of application

- Resilience in practice is demonstrated by each of the projects
- The validation of the proposed resilience management approaches has not yet achieved desired maturity levels for all critical infrastructures
- The rolling out of tools and indicators across different domains and scenarios is needed to test the validity and the applicability of their output to the management of resilience
Overall objective and outline

Projects: European resilience management
Guidelines

Talk: To motivate use of the different results
Changing landscape of society

Drivers
- Complexity, hidden interdependencies
- High expectations from citizens

Challenges
- Manage surprises, cascade effects

Changes
- Population
- Globalization
- Digitalization
- Extreme weather
- Emerging threats

Current disaster risk approaches
- Understanding risks
- Build defensive fortress
- Produce plans
- Train for defined events
Resilience as a concept and projects contribution
“The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to 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” UNISDR, 2009**

*Herrera adapt from Longstaff et al, 2013, Woods, 2015
** https://www.unisdr.org/we/inform/terminology*
IMPROVER & RESILENS

“key societal functions.... prevention, protection, mitigation ....”

I. REBOUND AND RECOVER

II. MAINTAIN STATE

III. EXTEND ADAPTIVE CAPACITY

IV. SUSTAIN ADAPTABILITY

Herrera adapt from Longstaff et al, 2013, Woods, 2015
SMR

“human vulnerability ....respond, recover and deliver timely restoration of basic services.... social engagement”

Herrera adapt from Longstaff et al, 2013, Woods, 2015
DARWIN & RESOLUTE

“changes, disturbances and opportunities...everyday operation, flexibility, self-organization, improvisation, brittleness, sources of resilience”

Herrera adapt from Longstaff et al, 2013, Woods, 2015
I. REBOUND AND RECOVER

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End users involvement
WHY?

• Contribute to the creation of the results

• Enable and facilitate the adaption of the project results

• Be prepared to adopt the project various versions of resilience management guidelines
Type of end-users

**Common:**
- National, regional and/or local governments and civil protection agencies management
- First responders
- CI operators
- Cities and urban (SMR)
- NGOs (DARWIN)
- The research and standardisation communities

*Figure: DARWIN Deliverable D3.2*
Interventions and tools
• Each of guidelines has its own scope, responding to different needs and requirements

• Include different tools, that can be considered as the “bricks we need to build resilience”

• Tools have been validated through implementation pilot processes

• These tools and guidelines are complementary!
Examples of tools developed

• **Definition** - Terminology: Definitions and Lexicon; Taxonomy, including terms and their semantical connections

• **Strategy**: Maturity Model; Guidelines to measure and understand the resilience of individual and interconnected CI systems

• **Analysis**: Concept Cards; Critical Infrastructure Resilience Index (CIRI), Technological, Organisational and Societal Resilience Analysis; Quantified Functional Resonance Analysis Method

• **Evaluation**: Risk Systemicity Questionnaire (RSQ) ReMMAT - Resilience Management Matrix and Audit Toolkit

• **Training**: Academic course on resilience management; Serious game using virtual reality; E-Learning Hub; Game-Based Training App

• **Tools for simulation and other**: City Resilience Dynamics Tool; Discrete Event Simulation tool for specific situations; Decision Support Platform; Stakeholder analysis questionnaire
1. **E-Learning Hub (RESILENS):** interactive platform containing *e-learning resources and repository* of supporting documentation, to support academic and continual professional development.

2. **DARWIN Resilience Management Guideline (DRMG Wiki):** Definitions from standards or literature are included. Top ten resilience concepts with interventions to support organisations in adopting a critical view on their own processes and tools they use to manage crises, and in enhancing them.

3. **Lexicon (IMPROVER):** It represents *key definitions related to resilience* agreed upon by the Project partners and stakeholders. All definitions will be transferable across borders, infrastructures and between the asset level and the policy level.

4. **Semantic Aware Taxonomy (RESOLUTE):** terms used in the project have been managed through a dedicated tool (SIDOC) where lemmas (form of a set of words) are disambiguated, semantically connected with other lemmas and then reused for buildings indicators.

5. **RMM (Resilience Maturity Model), (SMR):** is a strategic tool that provides an ideal roadmap for how the resilience building process should be. It helps to enhance the communication among stakeholders which increases their awareness, engagement and commitment on the resilience building process.
Evidence of benefits
**DARWIN Pilot Exercises vs Concept Card and CIs WPL: Deep Blue SrL**

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<tr>
<th>Pilot 1</th>
<th>Scenario</th>
<th>Concept Cards</th>
<th>Domains</th>
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</table>
|         | Aircraft Crashing      | 2.3. Roles and Responsibilities  
|         |                        | 4.3 NoticingBrittleness                                                       |         |
|         |                        | 7.1 Communication with Public                                                 |         |

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<thead>
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<th>Scenario</th>
<th>Concept Cards</th>
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|         | Radar Loss             | 2.1. Promoting Common Ground  
|         |                        | 4.1 Identifying Sources of Resilience                                        |         |

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<th>Pilot 3</th>
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|         | Disease Outbreak       | 2.3. Roles and Responsibilities  
|         |                        | 4.3 NoticingBrittleness                                                       |         |
|         |                        | 7.1 Communication with Public                                                 |         |

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<th>Pilot 4</th>
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|         | Collision between Oil  | 2.2 Establishing Networks  
|         | Tanker and Passenger    | 2.3. Roles and Responsibilities  
|         | Ferry                   | 3.1. Adapting to expected and unexpected                                     |         |
|         |                        | 3.2 Adapting Plans and Procedures                                            |         |
|         |                        | 4.2 Identifying Sources of Resilience                                        |         |
|         |                        | 4.3 NoticingBrittleness                                                      |         |
TIER1 cities (Glasgow, Donostia-San Sebastian and Kristiansand) have implemented the European Resilience Management Guideline developed in SMR Project.
Policy, standardization and current needs
SMR, RESOLUTE and DARWIN Projects took part in standardisation activities, because an early presence in the field of standardisation can lead to the following benefits:

• leading role in emerging technologies and innovations in general;

• public availability of relevant Projects’ results even having finished the project; and

• being part of the European Standardisation Community and thereby linking with relevant stakeholders.
Final conclusion

• Advance bringing theory closer to practice

• A nice set of complementary tools

• Still have some work to do it on integrating these tools in a meaningful way

• From protection to resilience, risk management complemented with resilience management

• An invitation to explore and use available results (our gifts for you)
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https://h2020darwin.eu/

**IMPROVER:** Dr. David Lange and Dr. Marianthi Theocharidou  
http://improverproject.eu/

**RESILENS:** Prof. William Hynes and Dr. Sheryl Lynch  
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**RESOLUTE:** Dr. Emanuele Bellini and Dr. Pedro Ferreira  
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**SMR:** Dr. Jose Maria Sarriegi and Saskia Maresch  
http://smr-project.eu/home/
I. Resilience as Questions?

Questions?