

FINAL CONFERENCE



SMART MATURE RESILIENCE

FINAL CONFERENCE REPORT

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EXECUTIVE SUMMARY

The Smart Mature Resilience held a joint conference on 10th April 2018 in Brussels, co-organised by the group of projects funded under the DRS-7 call. This event was the culmination of over a year of cooperation in two streams, both between the coordinators of the projects, who exchanged on the projects' research content, and the dissemination managers, who shared contact channels and collaborated on shared communication and dissemination activities.

Between these two groups, a combined White Paper was produced, which was launched at the event. This white paper is included in an annex. The event agenda was facilitated by each of the project coordinators and the topics covered were:

- Resilience Concepts and Understandings
- End User Led Solutions for resilience of Critical Infrastructure
- Resilience Interventions, Tools and Benefits
- Resilience Policy, Standardisation and Current Needs
- Status, Further Needs and Roadmap to Integration

As this event was designed with a focus on European-level policymakers and the research community, and the costs of the conference were lower than the foreseen budget in the project Grant Agreement (which planned for a full conference), the funds saved were re-utilised to hold an exploitation-focused event for cities in Bonn on 24th April 2018. The outcomes of this event are included in an annex.

AGENDA

Critical Infrastructure Resilience 2018

Convent Garden 2 (REA building), Auditorium Nowotny, 25th Floor, Place Rogier 16, Brussels, Belgium

April 10th 2018



Time	Session	Speaker
09.00	Registration and tea/coffee (1 hour)	
10.00	Conference Opening and welcome	Angelo Marino Head of Unit, Security Research. Research Executive Agency (REA). European Commission.
10.10	Resilience Concepts and Understandings	Ivonne Herrera (DARWIN)
10.30	End User Led Solutions for resilience of Critical Infrastructure	David Lange (IMPROVER)
11.00	Resilience Interventions, Tools and Benefits	DRS-7 Project Representatives
13.00	Lunch (1 hour)	
14.00	Resilience Policy, Standardisation and Current Needs	Rene Lindner, DIN (SMR) and Marianthi Theocharidou (IMPROVER)
14.30	Status, Further Needs and Roadmap to Integration	Pedro Ferreira (RESOLUTE)
15.45	Closing Session	William Hynes (RESILENS)
16.00	Conference close	

1. PRESENTATION: RESILIENCE CONCEPTS AND UNDERSTANDINGS



1.1 DR. IVONNE HERRERA (SINTEF), DARWIN PROJECT COORDINATOR

This session presented a collective view of resilience concepts and understandings of all five DRS-7 projects.

1.1.1 RESILIENCE CONCEPTS

Disasters affecting critical infrastructures (CIs) are wide-ranging. Examples in recent years include the volcanic ash cloud in Iceland (2010), Hurricane Sandy (2012) and the Deepwater Horizon oil spill (2010). Interdependencies can cause cascading effects between critical infrastructures. Shocks or stresses affecting one critical infrastructure system can have an impact on other systems. Society has also seen changes – in population, globalisation, digitalisation, extreme events and weather. These changes bring opportunities but also a lot of challenges.

Disaster risk approaches to date have focused on understanding risks, risk preparedness and plans and methods to reduce vulnerability to specific risks. In order to build resilience to unexpected events, a holistic approach is needed. It is crucial to address systemic complexity and hidden interdependencies, addressing not only what goes wrong, but what goes well, because we can learn from what goes well in crises.

Our focus in the DRS-7 projects was to move from theory to practice – by advancing our methods and engaging with end-users. For the joint white paper, we looked at urban resilience, at city resilience, at organisational resilience, resilience in ecology, and we see an exponential growth for publications on the topic. The projects conducted literature surveys to assess the current state of the art in the field. These worldwide literature surveys were also complemented with end-user surveys of what happens in different cities, in critical infrastructures, what topics were involved in terms of resilience.

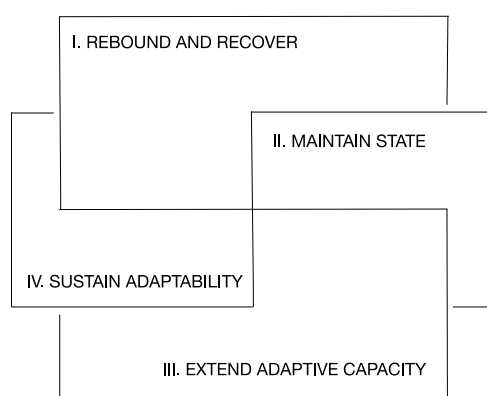


Figure 1: *Multiple Understandings of Resilience (Herrera adapt from Longstaff et al, 2013, Woods, 2015)*

The five projects see four views of resilience (Figure 1). The first two views talk about bouncing back, and the second two views discuss about bouncing forward. In the last view, we talk about even thriving



and taking advantage opportunities. The most influential definition of resilience for all projects is the definition of the United Nations Office for Disaster Risk Reduction (UNISDR): “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.”

Looking at what the projects have done in terms of resilience:

- IMPROVER and RESILENS look into key societal functions, how to preserve these functions, to maintain these functions ('rebound and recover' and 'maintain state')
- The SMR project focuses on city resilience and on how to respond, recover, timely delivery, and also citizen engagement ('maintain state' and 'extend adaptive capacity')
- DARWIN and RESOLUTE look at changes, disturbances, and even opportunities; flexibility, self-organisation, improvisation; seeing sources of resilience ('extend adaptive capacity' and 'sustain adaptability')

One area where the projects can improve and have more impact is working with projects focusing on climate change and having more cooperation and exchange with those projects.

Rather than providing a unique definition of resilience, the projects contribute to highlighting the importance and complementarity between different resilience views as a way to enhance an understanding of resilience among CIs. The most important message that the DRS-7 projects would like to state is that there is not one neat view of resilience, but there are contrasting views that can complement each other. Society's social systems and critical infrastructures adapt today.

1.1.2 DISCUSSION

In discussions, the point arose that it is often the department of climate change within a municipality that takes the lead to follow the project results. In some operational aspects, it can be beneficial to involve municipal staff working on environment and climate change.

2. SOLUTIONS FOR RESILIENCE OF CRITICAL INFRASTRUCTURE



2.1 DAVID LANGE – END USER LED SOLUTIONS FOR RESILIENCE OF CRITICAL INFRASTRUCTURE

This session presented the different approaches of end user involvement that the five projects have undertaken, as reported in chapter 3 of the white paper included above. Questions and discussions from the audience are summarized below.



Representatives from all of the five projects commented on how their end users have been a crucial asset for them to achieve their project goals. Although the involvement of end users was challenging, especially in the beginning, and forced the projects to rethink and adjust their ideas, all projects agreed that, ultimately, the end users lead to the success of the projects.

One representative from DARWIN's DCoP network commented that the involvement in the project has been beneficial for them as well, especially in terms of understanding resilience, what it is about and how it can strengthen their organization.

David Lange stated that the end user interaction in the beginning of the IMPROVER project resulted in choosing to work closely with existing risk management procedures, since that was a strong criterion from the CI operators. From the end users perspective, it was important to be able to continue working with existing procedures, and develop them to include resilience rather than starting from scratch with a completely new way of working.

2.2 MARIANTHI THEOCHARIDOU – RESILIENCE IN EU POLICY: OVERVIEW AND RECOMMENDATIONS



Public authorities are dependent on regional and national policy in order to be able to take concrete action on resilience development. EU policy and recommendations in many cases provides motivation and supports political commitment by member states, providing local authorities with the support and policy framework they need for resilience action. Marianthi Theocharidou, JRC and David Lange provided some insights into the results of the IMPROVER project on EU policy and recommendations relevant to the topic of critical infrastructure resilience.



2.2.1 COMPLEX RISK LANDSCAPE

Greater interdependence among different infrastructure networks is increasing the scope for systemic failures – whether from cyberattacks, software glitches, natural disasters or other causes – to cascade across networks and affect society in unanticipated ways.

Policies relevant to resilience in Member States and the EU include the Digital Single Market, European Security Agenda, Joint Framework on countering hybrid threats, Joint Communication on Resilience, Deterrence and Defence: Building strong cybersecurity for the EU, Communication on Launching the European Defence Fund and the EU Strategy on Climate Adaptation.

Policies in the field of Security & Critical Infrastructures include:

- 2005 - European Commission Green Paper
- 2006 - EPCIP
- 2008 – EPCIP Directive
- 2013 - Revised EPCIP
- 2015 - European Agenda on Security

2.2.2 NATIONAL CAPABILITY & EU-LEVEL CAPABILITY

According to the IMPROVER project's findings, Member States remain responsible for national security. However, the scale and cross-border nature of threats like cyber-attacks, climate change and hybrid threats make a powerful case for EU action. This action could include incentives and support for MS to develop and maintain more and better national capabilities or building EU-level capacity. The interconnected nature of the threat, as had been mentioned in the DARWIN project's presentation, requires a holistic approach involving a range of actors including the EU, Member States, industry, public authorities and civil society.

A new priority will be linking internal resilience with EU's external actions: synergies between defence policy and policies covering the internal market, industry, law enforcement and intelligence services.

2.2.3 RESEARCH

The EU is already working under Horizon 2020 to develop a sound evidence base to strengthen resilience, in various areas such as:



- Climate Adaptation
- Civil Protection
- Critical Infrastructure Protection
- Cyber-Security
- Security of critical transport infrastructure
- Energy security

2.2.4 RECOMMENDATIONS FOR POLICY

The DRS7 projects recommend that the follow approaches are needed:

- Reflect more the paradigm shift from protection to resilience in policy documents (MS or EU level)
- Move from risk assessment & management towards resilience management
- Balance between legislation and voluntary efforts by actors to enhance resilience

From CI protection to CI resilience

Policies	Aspects & Actors
EPCIP (2005-2008): The concept of resilience was not even mentioned	Organizational resilience <ul style="list-style-type: none"> • businesses, i.e. CI operators or operators of essential services
Commission review of EPCIP (2012): it already plays a small role	Technological resilience <ul style="list-style-type: none"> • CI systems, CI operators, safety and security manufacturers and vendors
NIS Directive (2016): continuity of essential services against incidents affecting the security of the network and information systems used for the provision of such essential services.	Societal resilience <ul style="list-style-type: none"> • National and local governments, communities and households • Link to Civil Protection and City Resilience



European and international policies relevant for resilience building include the EU Adaptation Strategy to Climate Change (2013), the UN 2030 Agenda for Sustainable Development (2015), the Paris Agreement (2016), the Sendai Framework for Disaster Risk Reduction 2015-2030 and the New guide on resilience at local level (2018).

Actors include national and local governments, communities and households. Challenges include engagement of multiple stakeholders and financial, practical, political, reputational, or other opportunities and constraints for cities

Examples of opportunities for integrating resilience thinking include project design, land use planning, budgeting and capital planning and formalization of the CRO Office. SMR would suggest, additionally, to include resilience thinking and co-creation in urban planning and municipal climate change planning processes.

There are a number of distinctions between traditional approaches to risk and the more comprehensive resilience thinking the projects have explored. Risk Assessments are standard practise at national, local, CI operator and facility level. Risk assessment is still the basis of Resilience management. SMR has built on this established structure with the Risk Systemicity Questionnaire, whereby traditional risk assessment processes can bring in more holistic approaches through facilitated consideration of the interconnectedness of risk. IMPROVER Resilience Assessment remains not widely operationalized. The SMR Resilience Maturity Model provides city with a means and process to carry out this kind of assessment.

2.2.5 DISCUSSION

A discussion session raised a number of questions, beginning with the issue of financing of implementation of the projects' research results. Several examples were brought up, of knowledge and tools being spread through networks of the end users involved in the projects. In these cases, the organizations themselves are financing the implementation. However, the possibility of financing implementation on a larger scale was not answered.

The question of regulation vs. public-private partnership was discussed, with both advantages and disadvantages brought up. The main arguments against adding regulation on resilience were that 1) private actors would have to invest resources in order to comply with the regulations and 2) that actors would only perform the minimum necessary to comply to regulations instead of actually using resilience as a tool to improve the organization. The problem of public-private partnership was

mentioned with regards to liability and information sharing. The discussion concluded that solutions to these issues must be found in order to implement the resilience concept in the most beneficial way.

2.3 RESILIENCE POLICY, STANDARDISATION AND CURRENT NEEDS - RENE LINDNER, DIN (SMR)



René Lindner (DIN) on behalf of the Smart Mature Resilience (SMR) project presented standardization in the DRS-7 projects.

As the SMR project has DIN, the German national standardization institute as a full project partner, SMR was the leading project in the DRS-7 group for standardization activities. Within SMR, DIN leads the work package for standardization (Work Package 6), supported by partners from ICLEI, Tecnun, University of Agder and Strathclyde University as Chairs and Co-Chairs of the standardization workshops initiated by the project, and with input from representatives of each partner organization.



5.3.1. INITIATION OF COMBINED STANDARDIZATION WORK

SMR initiated collaborative work between the five DRS-7 projects by holding a European Workshop on Resilience in Cities and Communities at the DIN premises in Berlin (Germany) on 4th April 2017 with a primary focus on standardization. The five DRS-7 projects, SMR, DARWIN, IMPROVER, RESILENS and RESOLUTE attended this workshop, as well as the RESCCUE project, funded under DRS9 and the RESIN project, funded under DRS 14.

At the workshop, information was provided on ongoing standardization activities, and in the ISO Technical Committees 292 and 268, and experiences were shared in interactive sessions where challenges and needs of cities and communities for building resilience were discussed as well as possible solutions and best practices exchanged.

SMR developed three CEN Workshop Agreements. All three groups included representatives of other DRS7 funded projects. These representatives were co-authors of the standard, participated in numerous writing calls and rounds of feedback of the draft standards.

1. CWA 17300 City Resilience Development – Operational Guidance: 1 representative of RESOLUTE
2. CWA 17301 City Resilience Development – Maturity Model: 2 representatives of RESCCUE
3. CWA 17302 City Resilience Development – Information Portal: 1 representative of RESCCUE, 1 representative of RESOLUTE

Details of the steps of their participation are included below.

5.3.2 STRATEGY FOR STANDARDIZATION IN SMR

Standardization potential was identified based on an extensive list of standards as well as input from the European Workshop and a survey of the cities in the SMR project. A series of preparatory activities for pre-standardization was initiated under the title “City Resilience Development” consisting of three CEN Workshop Agreements based on the five tools developed within the SMR project: the Resilience Maturity Model, Risk Systemicity Questionnaire, City Resilience Dynamics, Resilience Information Portal and Resilience Building Policies.

The process of development towards a CEN Workshop Agreement follows eight steps.

- 1 Administrative initiation: Formal initiation of the standardization project



- 2 Project plan> Set up project plan (incl. scope, objective, schedule); to be accepted by CEN
- 3 1st comment phase: Project plan on CEN website for at least 30 days for comments of general public
- 4 Kick-off: Defining rules, designating chair person, secretariat, presentation of first ideas/draft
- 5 Manuscript: In one or several meeting(s), development of the draft version of the manuscript; electronic sessions possible
- 6 2nd comment phase (optional): Manuscript provided online on CEN website for public comments
- 7 Consensus: Comments discussed, either integrated or declined with reasons until final consensus reached
- 8 Distribution: CWA distributed via CCMC to all national members for potential publication

Following approval, the CEN Workshop Agreement can be published.

5.3.3 CITY RESILIENCE DEVELOPMENT STANDARDS SERIES

The City Resilience Development series is composed of three pre-standardization activities, which will be published as CEN Workshop Agreements by the end of the SMR project period.

City Resilience Development

The Operational Guidance CWA has been based on the European Resilience Management Guideline (ERMG) produced by the SMR project. The workshop is composed of 14 cities, associations of cities and researchers of European R&I projects. The scope defines an operational framework for cities that provides guidance on local resilience planning and supports their efforts in building resilience.

The Maturity Model CWA has been based on the Resilience Maturity Model produced by the SMR project. The scope provides a framework to show the ideal path in the resilience building process of a city.

The Information Portal CWA has been based on the Resilience Information Portal produced by the SMR project. The scope provides a list of requirements for how municipalities can equip an



information system that facilitates resilience building through collaboration, communication, and engagement.

More information: <http://smr-project.eu/standards/>.

5.3.4 STANDARDIZATION ACTIVITIES AT AN INTERNATIONAL LEVEL

The SMR project established a liaison with ISO/TC 268 Sustainable cities and communities. SMR presented the standard series to ISO in 2018. As of September 2018, CWA 17301 City Resilience Development – Maturity Model has been included in *ISO/WD TS37107 Sustainable Cities and Communities - Maturity framework for sustainable and smart-enabled communities* with references to the CWA in the opening and throughout the text.

3 INTERVENTIONS, TOOLS AND BENEFITS

For the session “Interventions, Tools and Benefits”, the SMR coordinator presented the outputs of European Resilience Management Guidelines of all five DRS7 projects.



3.1 INTERSECTIONS BETWEEN PROJECTS AND TOOLS

The guidelines produced by the projects had mutually complementary target groups and scopes, responding to different needs and requirements. The guidelines include different tools, which the coordinator compared to bricks to ‘build’ resilience.



6.1.1 UNITS OF ANALYSIS

The units of analysis of the SMR project are cities or by extension, the network of European cities, while for other projects, they can be considered as a single Critical Infrastructure, a sector of Critical Infrastructures, the network of Critical Infrastructures.

6.1.2 THE SCENARIOS THEY FACE

The five projects take into consideration one or more of the following scenarios, which the 'units of analysis' should be resilient to:

- Sudden shocks
- Long term stresses
- Attacks
- Accidents
- Natural disasters
- Climate change
- Social dynamics

6.1.3 THEIR EXPECTED USE

The tools can be categorised by types. Beginning with work prepared in an interactive session in Berlin hosted by DIN in April 2017 and continued for the Community of Users workshop in September 2017, the tools have been categorised according to a number of criteria.



- Definition of the 'resilience' concept
- Strategy
- Analysis
- Evaluation
- Training
- Implementation
- Simulation
- Others

Development steps of categorisation

STEP 1: INVENTORY OF TOOLS AVAILABLE COMPILED IN WORKSHOP (LED BY DIN)

A series of categories were considered and discussed, and projects named applicable tools that could be considered to belong to these categories. The aim of the session was to develop an overview of the projects' final outputs.

Each project volunteered many tools and outcomes. As no routine working relationship among the group had yet been established, the project representatives found it important to represent all outputs of their projects. Later, as trust was built and the projects proceeded on the basis of complementarity rather than competition, the list was refined and some more peripheral outputs removed from the table.



Figure 1: Step 1 - DIN leads workshop and collects input, Berlin April 2017



Figure 2: Step 1 - Input is consolidated and revised, Berlin April 2017



Figure 3: Step 1 - Brown paper workshop outcome, Berlin April 2017

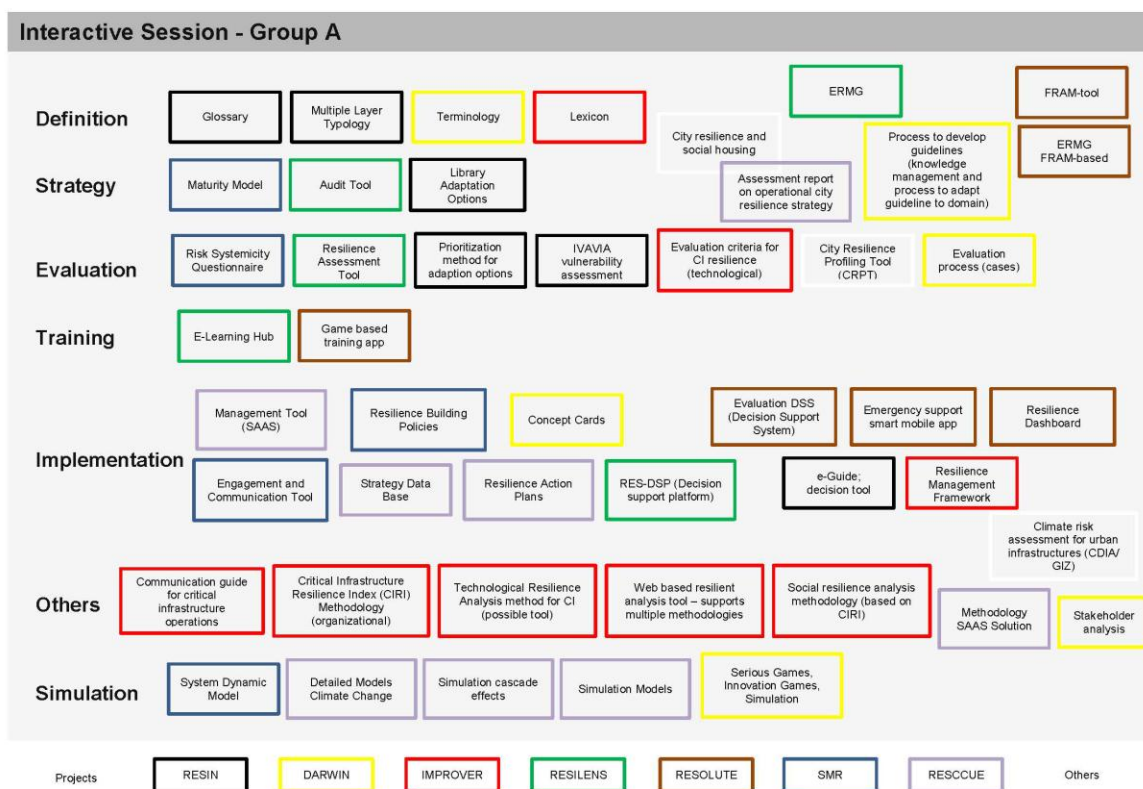


Figure 4: Step 1 - Table prepared by DIN for D6.3 summarizing outcomes of Berlin workshop

STEP 2: REVISION OF TABLE IN CONFERENCE CALLS AND EMAIL EXCHANGE INVENTORY OF TOOLS AVAILABLE COMPILED IN WORKSHOP (LED BY ICLEI)

The above table was discussed in a follow-up call as part of the regular coordination calls between DRS7 projects. The table was circulated and comments were invited. The updated table was intended to be displayed at the Community of Users event in Brussels in September 2017 to provide an overview of the combined projects' outputs.

Definition	Glossary (RESIN, Smart Resilience)	Multiple Layer Typology (RESIN)	Terminology (DARWIN)	Lexicon (IMPROVER)	City resilience and social housing (others)	ERMG (RESILIN)	Process to develop guidelines (knowledge management and process to adapt guideline to domain) (DARWIN)	FRAM-tool (RESOLUTE)
	Strategy	Maturity Model (SMR)	Audit tool (RESILENS)	Library of Adaptation Options (RESIN)		Stress-testing tool (Smart Resilience)		Assessment report on operational city resilience strategy (RESCCUE)
Evaluation	Risk Systemicity Questionnaire (SMR)	Resilience Assessment Tool (RESILENS)	Prioritization method for adaptation options (RESIN)	IVAVIA vulnerability assessment (RESIN)		City resilience profiling tool (CRPT)	Evaluation process (cases) (DARWIN)	Dynamic Resilience Checklist (Smart Resilience)
Analysis	Evaluation criteria for CI resilience (technological) (IMPROVER)							
Training	E-Learning Hub (RESILENS)		Game based training app (RESOLUTE)		Course on Resilience & Resilience Tool (Smart Resilience)			
Implementation	Management Tool (SAAS) (RESCCUE)	Policy Tool (SMR)	Concept cards (DARWIN)	Indicator based tool (Smart Resilience)	Evaluation DSS (Decision Support System) (RESOLUTE)		Emergency support smart mobile app (RESOLUTE)	Resilience Dashboard (RESOLUTE)
	Resilience Information and Communication Tool	Strategy Database (RESCCUE)	Resilience Action Plans (RESCCUE)	RES-DSP (Decision support platform)	e-Guide decision support tool (RESIN)		Resilience Management Framework	Climate risk assessment for urban infrastructure

	(SMR)						(IMPROV ER)	ture (CDIA/GI Z)
Others	Communica tion guide for critical infrastruct ures operations (IMPROVE R)	Critical Infrastruct ure Resilience Index (CIRI) Methodolo gy (Organizati onal) (IMPROVE R)	Technolo gical Resilienc e Analysis Method for CI (possible tool) (IMPROV ER)	Web based resilience analysis tool – supports multiple methodol ogies (IMPROVE R)	Social Resilienc e Analysis Methodo logy (based on CIRI) (IMPROV ER)	Methodo logy SAAS Solution (RESCCU E)	Resilienc e Assessm ent Guidelin es (Smart Resilienc e)	
Simulation	System Dynamics Model (SMR)	Detailed Models Climate Change (RESCCUE)		Simulatio n cascade effects (RESCCUE)	Simulation Models (RESCCUE)		Serious games, innovation games, simulation (DARWIN)	

Figure 5: Step 2 – Updated table following comments by DRS7 projects

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Definition		Terminology	Lexicon	ERMG	FRAM-tool	Glossary
Strategy	Maturity Model	Process to develop guidelines		Audit tool	ERMG FRAM-based	Stress-testing tool
Analysis		Resilience assessment guidelines	Critical Infrastructure Resilience Index (CIRI) Organisational resilience analysis methodology (Organizational) Technological Resilience Analysis Method for CI Social Resilience Analysis Methodology (based on CIRI)			
Evaluation	Risk Systemicity Questionnaire	Evaluation process (cases) – pilot trials	Evaluation criteria for CI resilience (technological)	Resilience Assessment Tool	Indicator based tool	Dynamic Resilience Checklist
Training		Training material associated to resilience concepts Collaborative mini game prototype using virtual reality Operational and managerial training of resilience prototype using serious games		E-Learning Hub	Game based training app	Course on Resilience & Resilience Tool
Implementation	Resilience Information and Communication Portal Policy Tool	Resilience Concept cards - Wiki application for development of and access to the guidelines	Web based resilience analysis tool – supports multiple methodologies Resilience Management Framework		Evacuation DSS + Emergency Mobile Smart App Resilience dashboard Urban DSSs data sharing Big Data Layer	Indicator based tool
Simulation	System Dynamics Model	Discrete Event Simulation tool for specific situations		RES-DSP (Decision support platform)		
Others		Stakeholder analysis	Communication guide for critical infrastructures operations			Resilience Assessment Guidelines

Figure 6: Step 2 – Updated table following comments by DRS7 projects



STEP 3: INTEGRATION OF TABLE INTO WHITE PAPER

The final result of the revised table formed the basis of the joint white paper and the outcome is contained therein. [See Annex](#)

6.1.4 END USERS

End users of the tools between the various projects varied in their scope and focus. While Smart Mature Resilience took local government practitioners and their local stakeholders as primary groups, other projects focused rather on national-level critical infrastructure providers and security and defence bodies into greater consideration.

6.1.6 ANALYTICAL TOOLS

Tools including the DARWIN Concept Cards, the CIRI Index developed by the IMPROVER project and the ERNCIP project, tools for technological, organisational and societal resilience analysis and the quantified functional resonance analysis method are relevant analytical tools.

6. DISCUSSION



Following the presentation was a lively Question and Answer format with a panel from across all of the DRS-7 projects. Themes of the questions were:

- Positive response across the panel to the DRS-7 co-operation across the projects and optimism that these links would continue and be used in the future to develop the resilience debate.
- The need for a single definition of Resilience in order to make the wider adoption of the concepts easier to promote.
- The need to recognise and factor in the human element to resilience and not rely solely on technology and the benefits that can bring.
- DRS-7 has developed valuable resources to support resilience, these systems need to be brought together and guidance given on how these variety of approaches and tools can be used together.

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- The issue of continued funding was raised in order to build on the work of the last 3 years and continue to develop an integrated suite of resources that supports improved resilience in infrastructure and communities.

7 PRESENTATION – STATUS, FURTHER NEEDS AND ROADMAP TO INTEGRATION: RESOLUTE



5.1 PEDRO FERREIRA (RESOLUTE)

DRS-7 projects have approached resilience management needs from considerably different perspectives, both conceptually and contextually. While these different approaches can be complementary, the challenges for integration are as important as the different objectives and scope adopted by each of the Projects.

DRS-7 has achieved significant developments in terms of conceptual clarity and of resilience management tools and approaches. However, these remain contained within specific contexts of



validity and each of them targets a limited scope of industry needs and priorities. The mapping of project conceptual and applied contributions must be mapped onto a comprehensive resilience framework, which is yet to be matured and validated.

The roadmap proposed is grounded on the development of a modelling activity, based on which conceptual boundaries can be demonstrated and against which different tools and methods can be validated. The mapping of the wide range of DRS-7 contributions onto this resilience model will give way to the identification of remaining gaps and opportunities for further developments in resilience management.

8 PRESENTATION – CLOSING SESSION – RESILENS



6.1 DR WILLIAM HAYES - RESILENS PROJECT CO-ORDINATOR

This final session wrapped up the event with an overview of all of the concepts from the White Paper and the discussions that they generated. Summarising the conference content under ‘findings and futures’, Professor Hynes pointed to the strength in the plurality of approaches evident in the five projects while advocating for a future in unity for this community of scholars. He stressed the importance of non-linear response models as a logical consequence of societies and indeed individual citizens being non-linear, complex entities that interact with critical infrastructure in a myriad of ways prior to, during, and subsequent to a disaster.



Professor Hynes also highlighted the KPIs of the DRS-7 tools, from the RESILENS E-Learning Hub to SMR's Resilience Maturity Model. A key message from this presentation was that resilience research has shifted policy focus from risk management to resilience management. He also highlighted the role of member states in establishing liability rules based on the notion that organisations should internalise the costs of the risks they produce and make wiser choices about the technologies they use. Emphasis was placed upon engaging with the European Standardisation Community in order to bring the excellent work conducted and tools produced to the attention of relevant stakeholders.

It was noted that the DRS-7 projects had created a rich, diverse range of resources to build resilient Critical Infrastructure and communities across the EU and that there was a sense of optimism in the room from all of the projects.

The White Paper Resilience Management Guidelines for Critical Infrastructures. From theory to practice by engaging end-users: concepts, interventions, tools and methods is seen as a key discussion document to take these concepts forward and continue the work of the DRS-7 group.

9 EVENT PREPARATION

Divison of responsibilities		
Administration / Budgeting	-Organise monthly meetings	ICLEI for initial, DARWIN for final 3-4 meetings
	-Circulate minutes from monthly meetings	ICLEI
	-Create event budget (third party suppliers and personnel hours)	ICLEI
	-Agree budget contributions by project	ICLEI
	-Monitor and review spend	ICLEI
Venue	-Source venue for event	All partners explore options, (venue finally offered by European Commission)
	-Visit venue	ICLEI
	-Confirm booking and initial requirements	ICLEI
	-Event meeting with venue	ICLEI
	-Confirm access day before event	ICLEI
	-Liaison with venue	ICLEI / RESILENS
Speakers	-Identify theme and programme of event	Programme committee (all projects) overview by ICLEI
	-Research suitable speakers for event	Programme committee (all projects) overview by ICLEI
	-Identify keynote speaker	Programme committee (all projects) overview by ICLEI
	-Identify topics for presentation at conference	Programme committee (all projects) overview by ICLEI
	-Draft letter to invite speakers to conference	DARWIN (template)
	-Confirm speakers	Programme committee (all projects) overview by ICLEI
	-Issue guidelines on presentations to	Programme committee (all

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	speaker (duration, key messages, deadline for delivery of presentation)	projects) overview by ICLEI
	-Liaison re travel and accommodation	Each partner responsible for own speakers
	-Draft speaking notes for the MC	Resilens
Branding / Visual Identity	-Draft branding and visual identity for event (logo, Twitter banner, banner stand, conference packs, USB keys, etc.)	RESOLUTE
Agenda	-Confirm speakers	Programme committee (all projects) overview by ICLEI
	-Agree draft agenda	Text by programme committee, layout by RESOLUTE
	-Circulate agenda to speakers	Each project will communicate with own speaker
	-Circulate agenda to invitees	DARWIN
Registration website	-Draft content for registration website	RESOLUTE
	-Set up online registration	RESOLUTE
	-Liaise with web designer to activate website	RESOLUTE
Invitations	-Each partner to compile invitation list for event	All partners
	-Draft 'Save the Date' notice for approval	RESOLUTE
	-Issue 'Save the Date' notice to approved invitees	RESOLUTE
	-Draft invitation for approval	RESOLUTE
	-Issue invitation and agenda to approved invitees	RESOLUTE
	-Projects to issue invitation to their own invitation lists	All partners
	- Sending of Save the Date via joint resilience newsletter	ICLEI
AV	-Agree AV requirements - PowerPoint, roving mic, screen, projection, lectern and top table microphones	ICLEI
	-Confirm AV requirements	ICLEI
	-Supervise installation / removal	ICLEI
	-Send presentations to AV company if available	DARWIN
	-Develop holding slides	RESOLUTE
	-Provide holding slides to AV company	DARWIN
Catering	-Request menu options	ICLEI

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	-Agree catering options	ICLEI
	-Liaise with caterers - provide agenda and dietary requirements	ICLEI
Room Branding/Display	-Agree branding requirements	Programme committee
	-Directional signage, name badges, holding slides and name plates	RESOLUTE
	-Order tables from venue (if required)	ICLEI
Conference Pack	-Agree contents / format of pack - agenda, attendees, feedback forms, speaker biographies	Programme committee
	-Develop feedback forms	RESOLUTE
	-Organise presentations for burning onto USB key	DARWIN
	-Compile contents	DARWIN
Registration	-Manage RSVPs	DARWIN
	-Provide weekly update on registrations to date	RESOLUTE
	-Confirm final attendance number prior to event	RESOLUTE
	-Circulate final registration list to partners	RESOLUTE
	-Manage registration at event	IMPROVER
	Name tags	IMPROVER
Photography & Videography	Photography	ICLEI
	Hosting of photos on Flickr	ICLEI
	Videography	DARWIN
	Video editing	DARWIN
Media	-Draft media notice for approval	DARWIN
	-Issue media notice and follow up	DARWIN
	-Draft press release for approval	DARWIN
	-Issue press release and follow up	DARWIN
	- Monitor catering, AV and other supplier activity	ICLEI
	-All staff to meet 1 day before the event	All projects
	-Collect evaluation sheets	RESILENS
	-Remove all material from venue	IMPROVER
	-Thank you emails to suppliers	DARWIN
Follow Up	-Draft thank you letters to speakers	DARWIN
	-Upload conference material to conference website	DARWIN
	-Upload video recording to conference	DARWIN

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	website - Share press release photo - Upload and share photo gallery	ICLEI ICLEI
	-Review feedback forms and compile post-event report	RESILENS with input from all partners
	-Review media coverage and compile report	RESILENS

ANNEX I: ATTENDEE LIST

Attendee's name	Attendee's first name	Purchaser's professional company
MARINO	Angelo	REA
LINDNER	Rene	REA
CARARE	OCTAVIAN	Photographe
GODLOVE	Chris	THINKCities Consulting
DOBRISAN	Cristina	North East RDA
BELLINI	Emanuele	University of Florence
NESI	Paolo	University of Florence
HUYGENS	Filip	Headline NFP
ANTUNES	Dalila	Factor Social
LANGÉ	David	the University of Queensland / RISE
IGOR	linkov	
TELHADO	Maria	Lisbon municipality CML
HYNES	William	Future Analytics Consulting Ltd
CAVALLINI	Simona	Fondazione FORMIT
MIGUELSANZ VILLANUEVA	Irene	
GALLAHER	Sam	Skills for Justice
ABBOTT	Paul	MTRS3
GERARD	Marie	ENGIE
JONSON	Carl-Oscar	Center for Disaster Medicine, KMC
PAUZIÉ	Annie	Ifsttar
CRIEL	Xavier	FPC Risk
TEIXEIRA	Rui	Municipality of Barreiro
CABANAS	David	Municipality of Barreiro
HEED	Daniel	Swedish Redcross
GAITANIDOU	Evangelia	CERTH/HIT
FERREIRA	Pedro	Lusófona University / Instituto Superior Técnico
CARUSO	Saverio	Università Cattolica del Sacro Cuore
TESTELMANS	Rob	City of Geel / Darwin DCoP
THEOCHARIDOU	Marianthi	European Commission, Joint Research Centre
LAPEYRE	Guillaume	Research Executive Agency
O BARR	Lucia	DBI (IMPROVER)
ROSENQVIST	Hannah	IMPROVER (DBI)
GONZALEZ	Jose Julio	University of Agder
POUSTOURLI	Aikaterini	EC DG HOME
COOK	Rosalind	United Nations Office for Disaster Risk Reduction
SPARF	Jörgen	Mid Sweden University
HERRERA	Ivonne	SINTEF
MAJCHRZAK	Tim A	University of Agder
SAVE	Luca	Deep Blue srl
NOLAN	Bill	Irish Water
SARRIEGI	Jose M	Tecnun
KESSIE	Bryan	Skills for Justice Enterprises
EDEN	Colin	University of Strathclyde
LATINOS	Vasileios	ICLEI Local Governments for Sustainability
GRIMES	Clara	ICLEI - Local Governments for Sustainability
VALENTINA	Cedrini	ENAV
LORENZA	Scotti	Istituto Superiore di Sanità
GIUSEPPINA	Mandarino	Istituto Superiore di Sanità
BERGERHAUSEN	Ulrich	Federal Highway Research Institute
KIERAN	Judith	Carr Communications
VOEGELE	Charlotte	HUMANIST
MENDOZA	Lucile	HUMANIST
LYNCH	Sheryl	FAC
FINGER	Jörg	Fraunhofer Institute for High-Speed Dynamics, Ernst-Mach-Institut,
ALBERTO	Paulo	EDP Distribuição



ANNEX II: FINAL CITY EVENT REPORT

SMART MATURE RESILIENCE

DELIVERABLE 7.9: REPORT OF THE
CITY RESILIENCE CONFERENCE

ICLEI European Secretariat | November 2018

	Report of the City Resilience Conference
Deliverable no.	D7.9 (Annex)
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EXECUTIVE SUMMARY

This document reports on the final City Resilience Conference of the Smart Mature Resilience (SMR) project. The workshop was organised by ICLEI European Secretariat and took place on 24th April 2018 in Bonn, Germany, back-to-back with the 5th Open European Day 2018, an event focusing on urban adaptation and resilience, also organised by ICLEI European Secretariat since 2013.

The event was chosen to take place together with the Open European Day, to benefit from the extensive pool of cities the latter attracts every year, and in this way maximize the dissemination potential of the SMR project results.



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1. INTRODUCTION

This document reports the outcomes of the final city-focused event of the Smart Mature Resilience (SMR) project. The workshop was organised by ICLEI European Secretariat and took place on 24th April 2018 in Bonn, Germany, back-to-back with the 5th Open European Day 2018, an event focusing on urban adaptation and resilience.

The event was designed specifically with the objective of dissemination and exploitation to the project's primary target group of cities, as a complementary event to the joint final conference held on 10th April 2018, which had a target group of European-level policymakers, Brussels-based stakeholders and scientific researchers.

The event was chosen to take place together with the Open European Day, to benefit from the extensive pool of cities the latter attracts every year, and in this way maximize the dissemination potential of the SMR project results.



2. WORKSHOP PREPARATION

Preparation activities

The following preparation activities were undertaken between partners to prepare the workshop:

- Periodic teleconferences
- Screenplays developed and shared between partners
- The final agenda was shared with partners 2 weeks before the meeting

The following materials were provided in advance in order to support the cities in preparation for the workshop:

- Workshop agenda (see Annex II)
- Invitations to external speakers
- Workshop facilitation guide/screenplay, made available a week before the workshop, used for facilitators' briefing
- Guiding questions: all tiers of cities were asked to prepare for the following guiding questions:

What was your city's ambition when starting the project?

What was your specific department's/organisation's ambition when starting the project?

Your approach (including what steps were taken, who took what role, how was the pilot testing process ...)

What you learned about resilience in your city and outlook to the future

Lessons or advice that other initiatives and/or city administrations should take into account

In 2015 I thought City Resilience was about ...

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In 2018 I am thinking City Resilience is ...

In 2015 I thought what my city needed was ...

In 2018 I am thinking my city needs...

In 2015 we had these projects on resilience...

In 2018 we have or planning these projects on resilience...



3. WORKSHOP EXECUTION AND OUTCOMES

Holger, Deputy Regional Director of the Sustainable Resources, Climate Adaptation and Resilience Department, ICLEI, acted as a moderator of the session.

3.1 TOWARDS A EUROPEAN RESILIENCE MANAGEMENT GUIDELINE - LESSONS LEARNT, CHALLENGES AND OUTLOOK

Jose Maria Sarriegi, SMR project coordinator and first keynote speaker of the day guided the audience through the project's 4 years of life, recalling its main outcomes (the set of 5 tools, besides the European Resilience Management Guideline), reviewing the challenges faced on the way, sharing keys of success and the many lessons learnt.

The main outcome of the SMR project, as mentioned above, is the European Resilience Management Guideline, defined as a framework that aims at training and offering support to municipalities and relevant stakeholders in implementing an integrated approach towards city resilience, directing all available resources to well-defined goals, securing transparency and based on democratic principles of decision-making.

The guideline is supported by the SMR set of tools, five strategic, interactive resources that allow cities and municipalities to identify their stage of resilience maturity and help them evaluate and improve their adaptation strategies while identifying risks and priority areas in where to act. These five tools are 1) a Resilience Maturity Model, 2) a Risk Systemicity Questionnaire, 3) a Resilience Information Portal, 4) a City Resilience Dynamics Tool and 5) a Resilience Building Policies Tool.

As many stories of success, the project was born from an idea in a constant stage of evolution that, through a process of co-creation, discussion and coordination among a team of enthusiastic and committed individuals, led to solutions to common concerns. The process was not free of challenges,



some of them arising at early stages of the project while others coming to light more recently, being these last ones especially tricky since they appeared only after the outcomes of the project had materialized. These included issues with identifying and engaging relevant stakeholders, establishing a common understanding of resilience, understanding the internal policy context of the cities and the way in which the project's outcomes may influence policy developments. Furthermore, articulation of the project's added value became easier as concrete outputs became available as a basis for demonstration. Among the initial concerns, the most notable were creating impact on policy makers and reaching cities, not only those taking an active part in the project, but also many other European Cities that seek to build up resilience. Indeed, one of the project's current goals is to multiply the reach of the tools beyond the project consortium. This was no easy task considering the variety of contexts that these cities face and bearing in mind that the concept of urban resilience is something of varying familiarity to practitioners in European cities. Besides this, the coordinator explained, keeping the team together was also a major concern, since ensuring a good communication within the team and homogenising approaches and interests, especially between groups as diverse as policy makers and academia, is always a challenging task.

The project coordinator explained that although not using this concrete expression, the idea of co-creation was already considered under different terms. Talking about a management model, there is no room for isolation, and researchers need to be conscious of that. They need to be prepared to receive criticism, analyze, accept it and be able to adapt their results to the needs of the end-users. At the same time, end-users need to understand that researchers are not only there to satisfy their requirements. There is a need to reach an equilibrium, since the results of the project are meant to serve the whole community. Here relies the effectiveness of collaboration.

3.2 CO-CREATION APPROACHES TO RESILIENCE- PLANNING: LESSONS FROM THE SMR PILOT IMPLEMENTATION

ICLEI Europe opened the session with an inspiring quote:



“Cities have the capability of providing something for everybody, only because, and only when, they are created by everybody.”

When asked to define his role - the role of a co-creator- ICLEI Europe explained: an ideal co-creator is a person that understands what needs to be built and facilitates the process by bringing voices together in order to identify common areas of interest, shared challenges and suitable solutions for all.

Why is this especially relevant in a City context?

Municipalities are constituted by complex mechanisms and actors, and the interaction between them is not always easy , resulting in scarce and interrupted collaboration that may lead to lack of data availability and knowledge on the costs and benefits of adaptation and resilience activities, lack of indicators that measure the success of these activities or silo thinking and working (among others).

What became evident within the project is that in practice, cities are political organizations which require regular planning of their activities and need to provide public services to their citizens. With all, one of the biggest challenges of the co-creation process within SMR was ensuring the proper interaction and understanding between cities and researchers.

ICLEI Europe explained that conducting a targeted stakeholder mapping within each city could be a possible way to sort this last issue, for which it is previously necessary to answer two questions: what is the vision of the City and where the City wants to go. This activity will build the foundations of a solid stakeholder engagement process that would boost the holistic approach required to effectively undertake resilience management.

Within the SMR project, the co-creation process was acknowledged to achieve a series of goals:

- Awareness raising on city resilience and sustainability
- Improved decision support at a local level in cities
- Enhanced trust in local and regional governance
- Activation and mobilization of citizens through co-creation activities
- Contribution to a sustainable and resilient economy and society that respects the environment
- better perspectives for a bottom-up inclusive resource governance at a local level
- promote mainstreaming processes of resilience strategies into local plans
- prioritize interventions evaluating potential impacts



3.3 SHARED INSIGHTS ON BOOSTING LOCAL PROGRESS FOR RESILIENCE - HOW THE CITIES MADE USE OF THE SMR KNOWLEDGE TO FURTHER BUILD LOCAL RESILIENCE

This session focused on the insights of the Tier 1 Cities of the project regarding the use of the tools and how they have benefited from them. The three Tier 1 cities (San Sebastian, Kristiansand and Rome) also shared with the audience what co-creation has meant to them, and how they have applied this approach within their own contexts to build up local resilience.

The Senior Technician at the Strategy office at San Sebastian representing the city of San Sebastian is well aware of the potential of co-creation: the Strategy Office works together with Tecnalía and the Basque Government on the development and implementation of the KLIMA 2050 Strategic plan on integrating mitigation, adaptation, resilience and nature based solutions. In this sense, the SMR tools proved to be effective in bringing together stakeholders from a variety of backgrounds and fields of expertise, and enhancing discussion among them, making concepts such as "cascading effects" and "transversal relationships" accessible and easy to understand. Originally, some of the challenges the City faced while testing the tools involved the lack of stakeholders' familiarity with the concept of urban resilience itself and the complexity of processes that it implies. SMR tools helped stakeholders to better visualize these processes (risks, interconnections, areas of action) and build a culture of resilience. The language barrier and the need for translation as a dedicated activity in order to facilitate dissemination and exploitation was emphasised.

The urban resilience and natural hazard expert from the City of Rome shared with the audience the measures of the City to face resilience. The city is currently engaged in the creation of urban gardens, a good practice that is perceived as an overarching solution for a variety of issues, including the soil sealing and the consequent increased risk of flooding, the degradation of abandoned areas and the marginalization of social groups, while developing a sense of belonging of the inhabitants to the territory, contributing to the security of citizens and also addressing the issue of loneliness and alienation of the elderly population.



For the Project Manager at the City of Kristiansand, the most important thing Kristiansand learned [through the SMR project] is the holistic approach to resilience. The process to achieve full understanding of the term was one of the struggles that Kristiansand faced throughout the project. Now, the city understands that resilience is a state to be reached through a deep process of cooperation and collaboration among stakeholders both from inside and outside of the Municipality. "When you work together and cooperate together, the outcome is resilient". And it is not a mere process of recovery after a disturbance or an event, but to bounce forward, achieving a new state of preparedness and integrating some sort of improvement.

3.3.1 CITY RESILIENCE SHOWCASE

An interactive session was organized in order to enhance further dialogue among the attendees, for which the mass of participants was split in 5 smaller groups of ca. 10 people, each one of them engaging in parallel round table discussions.

Each of the clusters counted with a SMR City representative, an external speaker (representing a city associated to the project or a relevant stakeholder), a tool developer and in most cases, an ICLEI representative.

TABLES	SMR CITY	EXTERNAL SPEAKER	FACILITATORS
TABLE 1	<u>Kristiansand</u>	Marco Cardinaletti, Region of Emilia-Romagna	Clara, Jose Julio
TABLE 2	<u>Rome</u>	Helena Perxacs Motgé, Provincial Council of Barcelona	Susan, Mihoko
TABLE 3	San Sebastian	Glen Dervishaj, Politecnico di Torino	Veronica, Sarri, Tim
TABLE 4	Bristol	Enrico Ponte, Risk and Resilience Expert, GeoAdaptive	Vasileios, Marta
TABLE 5	Vejle	Giampaolo Tarpianti, Comune di Udine	Serene, Colin

To guide the dialogue, the following agenda with points to discuss was provided:



- **14:50 – 14:55** Short introduction round (ca. 3 min)
- **14:55 – 15:05** A brief resilience inside story by the SMR City (ca. 10 min), touching upon:
 - o The ambition of the SMR city when starting the project
 - o Followed approach (including what steps were taken, who took what role, how was the pilot testing process ...)
 - o Lessons learned about resilience in the specific city and outlook for the future
 - o Lessons or advice that other initiatives and/or city administrations should take into account
- **15:05 – 15:15** Short presentation from the external speaker and reflection from an external initiative on city resilience from their own experience (ca. 10 min).
- **15:15 – 15:25** Round of questions (ca. 10 min)
- **15:25 – 15:45** Discussion around the leading questions (ca. 20 min).
- **15:45 – 15:50** Wrap-up: what do the participants take home from this discussion (5 min)+ what to give back to plenary
- **15:50 – 16:00** reporting back to plenary
-

The outcomes were gathered in A3 pieces of paper and later shared with the bigger group.

Kristiansand

The Norwegian city of Kristiansand suffered from devastating flooding in autumn 2017. Lessons from the floods and participating in project are putting the municipality of Kristiansand on the right track towards increased resilience to disasters and crises. Silje Solvang, City of Kristiansand (Norway) said, “We are a very small city, we are only 90,000 inhabitants, and to learn and see that other cities have similar challenges and similar obstacles due to law and leadership and politicians: it has been very good for us to know that we're not the only one.” For Silje, one of the most valuable outcomes of the participation in the SMR project has been the cross-sectoral collaboration.

Rome

The main efforts of the City of Rome currently rely in setting up a Resilience Office as soon as possible. Pierluigi Potenza believes that the SMR tools will help bringing more clarity on resilience and steps to follow. Pierluigi sees their capacity to involve different stakeholders in the resilience management process as an essential feature, which he thinks could build cohesion between the different sectors operating within a Municipality.

San Sebastian



Judith reviewed the stages that San Sebastian faced dealing with resilience through the project. Before the project, San Sebastian had difficulties working with local stakeholders and other administrations and the desire to learn from more advanced cities was a motivation to be fully engaged with SMR. San Sebastian had the chance to work with several city departments during the project, which resulted in a more cooperative way of working. Now, after almost 4 years of involvement in SMR, resilience is perceived as a common language that can facilitate the dialogue among different actors.

Bristol

When Bristol joined the project, in 2015, much of the work within the resilience field – not having yet been identified as resilience - was very much about future proofing places and infrastructure. Lucy Vilarkin, Bristol City Council, explained that the emphasis has more recently shifted onto people and organisations. “It’s been brilliant working with other European cities... It’s great having the ability to build a strong peer network with our counterparts of the European cities and also to get outside of our comfort zone. You can get very locked into your own way of thinking, a very UK-centric approach, so we’ve been able to widen our perspective and understand the other challenges other European cities are going through,” she reported.

Vejle

The city of Vejle, part of the 100 Resilient Cities network, released its resilience strategy on 17 March 2016. Vejle is one of the 10 Danish cities at a higher risk from flooding. Some of the biggest challenges that the City is currently facing is the lack of social cohesion and a generalized apathy to take action. Therefore, involving citizens in sustainable initiatives to increase resilience is a priority. One of the main motivations of the City to join SMR was overcoming this last challenge by developing a common pathway to resilience that citizens perceive as their own and finding innovative solutions. The project provided the city with a new way of thinking and would be happy to transform the SMR tools into an online course accessible to related stakeholders and municipalities that would like to learn more. The city recognizes having become most astute, capable of critically assessing internal procedures, better understanding underlying issues and better able to transform theoretical concepts into concrete actions to be followed by practitioners. The city is currently working in an awareness-raising program to teach the public -with an emphasis on children - about social resilience. The City can proudly say that thanks to these efforts in addressing resilience from a holistic approach (combining aspects such as social cohesion and critical infrastructure), decision-makers are listening when resilience is mentioned.



3.3.2 EXTERNAL SPEAKERS PROFILES

Marco Cardinaletti, Region of Emilia-Romagna

Marco shared innovative communication methods to disseminate project results to stakeholders in the fields of adaptation and resilience, including a children's theatre performance. Marco took the occasion to explain the three steps that he considers essential in order to lift municipalities situation towards resilience: 1) investment, 2) international recognition and 3) local autonomy. The City is currently drafting PRIMES, which was born in an effort to transition from a passive approach towards resilience to a proactive approach.

Giampaolo Tarpignati, Comune di Udine.

Mr Tarpignati shared some of the main challenges that Udine is facing or is likely to face in a near future. Earthquakes, flood hazards, nuclear hazards and last years's storm causing economic losses worth €7m have prompted the need to build up urban resilience. Although there is still much to do, Udine is taking action. As a member of the Covenant of Majors, the City has already foreseen some adaptation actions in its Executive Municipal Plan 2016 with regards to water management measures tackling the hydro-geological risk, energy efficiency in buildings, and an urban regeneration project. As further measures, the City is currently working on a National Adaptation to Climate Change Strategy that includes vulnerability and risk assessments, a spatial plan, and a sectoral plan. In discussions, the attendee cities commented on the outstanding climate commitment of Udine and commended the municipality for encouraging their larger neighbouring municipalities to take climate action.

Helena Perxacs Motgé, Provincial Council of Barcelona

Ms Perxacs Motgé discussed the opportunities and challenges of the local economy and society to adapt to climate change. As part of her work in the Provincial Council of Barcelona, Ms Perxacs Motgé provides support to a number of municipalities in the province of Barcelona, works with stakeholders to improve local resilience and adaptation, particularly in terms of agriculture, forestry, fishery and tourism in different areas in Catalonia. Although the city is well familiarized with the concept of resilience, she thinks that citizens could be more involved in the decision-making, highlighting the importance of involving stakeholders through platforms to build-up resilience and adaptation strategies. Ms Perxacs Motgé found that the tools and methodologies developed by the SMR project



could be directly applicable for this context, explaining, “It was good to get ideas from the tools and resources developed during the SMR project. They will try to implement the use of the tools in projects such as CLINOMICS, and to use these methodologies for the discussions with the stakeholders to increase their resilience and adaptation to climate change.”

Enrico Ponte, Geoadaptative

Enrico Ponte, Risk and Resilience Expert, presented one of the main outcomes that GeoAdaptive (the development planning and strategy company where he works) has recently produced: an integrated Evaluation and Adaptation Planning tool. The tool provides the insights that businesses, communities and homeowners need to assess their vulnerability to extreme natural events. It additionally provides them with risk reduction strategies through a customized set of adaptation measures prioritized according to their specific needs, opportunities and risks.

Glen Dervishaj, Politecnico di Torino

Glen shared with the group a new analytical approach to evaluate the level of a post-disaster adaptation of communities based on their resilience. He has also been involved in designing the Dependence Tree Analysis, which helps weighting a series of indicators previously set by the Hyogo Framework for Action (HFA) according to their contribution towards resilience.



4. OPEN EUROPEAN DAY 2018 SUMMARY

Following the Smart Mature Resilience Final City Resilience Conference, the Open European Day was held for the fifth edition back-to-back with the Bonn Resilient Cities conference on 25th April 2018. European cities and key adaptation voices from different institutions converged at the 5th OED to exchange and debate on the most pressing issues around climate adaptation and urban resilience. Cities have lauded previous years' editions as inspiring and informative, particularly due to the characteristic interactive format and emphasis on exchange and discussions: the OED is PowerPoint-free zone. An audience of 165 participants (from more than 40 cities) gathered in Bonn.

This year's sessions focused even more on city-to-city exchange on local adaptation and resilience planning and invited European cities of all sizes and regions to discuss their current adaptation and resilience efforts and participate in a variety of interactive panel discussions. Experienced front-runners and newcomer cities presented their challenges, while representatives of EU institutions, researchers and practitioners collectively explored solutions and arising opportunities for city-to-city collaboration and debate.

SMR Tier 1 city of Kristiansand participated in a session entitled: Insurance for urban adaptation and resilience, organised by ICLEI Europe and facilitated by Ramboll. The session presented examples of how cities and the insurance sector can work together to ensure urban adaptation and increase resilience. Participants heard from the city of Budapest about an extreme weather event during the winter of 2014 and then also on how insurance loss data is used at municipal planning in Norway from both the city of Kristiansand as well as from the insurance sector represented by Finance Norway.

SMR Tier 2 cities of Bristol and Rome, together with Tier 1 city of Donostia/San Sebastian co-facilitated a training session, led by the Strathclyde Business School, on the use of the Risk Systemicity Questionnaire. The session was titled: Protection of critical infrastructure and was shared with the Fraunhofer Institute. Critical infrastructure (CI) refers to those physical structures and facilities of vital importance to a city's economy and society. Its failure or degradation may lead to dramatic consequences for the cities' functionality such as supply shortages or disruption of public safety. Its protection is, thus, essential in a resilience-building process at local level. Both Smart Mature Resilience and RESIN are projects that have developed tools aiming to increase urban resilience to hazards, tackling issues such as preparedness, leadership and governance, cooperation among stakeholders or CI.



In this session, two of these tools were presented by researchers from Strathclyde Business School and the Fraunhofer Institute: the Risk Systemicity Questionnaire (SMR) and the IVAVIA tool (RESIN), respectively. While the first one is a powerful tool to identify local risks and their repercussion, explore interconnections and set priorities, the second one is a methodology that enables the identification of geographical hotspots of vulnerability of CI.

SMR Tier 3 city of Thessaloniki and Tier 3 city of Manchester participated in a session that focused on the 5th step of the European Resilience Management Guideline, which is Monitoring and Evaluation. Monitoring and Evaluation has attracted a lot of attention at the national level, and several countries have already developed frameworks to track implementation and evaluate the effectiveness of national level adaptation policies and measures, improve learning and increase accountability. At the city level, less progress has been achieved in this area (EEA, 2016), with the selection, development and application of adaptation indicators and monitoring systems being identified among the main knowledge gaps for cities. As the number of cities with an adaptation and resilience strategy rises, however, M&E is becoming of increasing importance. For example, M&E may help ensure the effectiveness, efficiency and equity of adaptation interventions and inform the revision of strategies when needed. Although there is not a 'one-size-fits-all' approach, sharing experiences and lessons-learned can be a valuable support from cities to cities in developing or revising their M&E frameworks.

This session aimed at facilitating peer-to-peer learning on the topic of M&E for urban adaptation. It explored the recent developments in city level M&E frameworks and discusses the various benefits and challenges of this process. Given the relatively young age of this evolving field of practice, the session focused primarily on the objectives and the methodologies of existing city level M&E frameworks. The session identified key knowledge gaps and other barriers that cities working in this area will need to overcome in the near future. Other contributors in the session were the cities of Paris, Helsinki and the Greater Manchester Combined Authorities, also engaged in SMR as Tier 3 city.

Finally, the Tier 3 city of Athens, participated in a training session that was titled: Financing and Funding for Urban Adaptation and Resilience. Finding the means for financing adaptation measures in cities is often cited as one of the key barriers in taking adaptation action forward. Over the recent years a multitude of financing and funding sources supporting adaptation to climate change have become available to European municipalities; and an increasing number of local authorities are pioneering and testing their own innovative approaches to adaptation funding. It is, however, essential to build up the capacities of public administrations to enable the access to adaptation funding and financing as well as to enhance the know-how on developing tailored mixes of traditional and



innovative sources. This session hosted a training by two adaptation financing and funding bodies – the European Investment Bank and the LIFE Fund, focusing on the key aspects for developing successful proposals. Furthermore, cities shared their experiences of setting up and running their own adaptation funding approaches and Moody's credit rating agency discussed on the role of city credit rating. Other contributor to this session was also the city of Paris, while the SMR tier 1 city of Kristiansand was contributing significantly to the discussion with questions from their place among the audience.



5. CITY INTERVIEWS

During the event, ICLEI European Secretariat conducted interviews with the SMR cities and with external participants.

5.1 CITY OF KRISTIANSAND – TIER 1 CITY

Interview with Silje Solvang

“The most interesting is that [participation] gives Kristiansand an international platform to promote themselves, but also to learn from others. To be better, you need to learn from others than your own and you can’t just do the normal thing. We are changing, the cities are changing, the world is changing and we also need to see outside the borders, to learn and to share information. And I think ICLEI is a great opportunity and a great platform for us to do that...”

There is always an opportunity to learn but I would say there's limitation for what you learn if you don't cooperate with other cities and also other cities across the country borders. So if you want to embrace the changes and the challenges, because what happens in the world will affect you on a local level at the end, so I think that's the most important thing that you need to look outside to be better, and to learn, and develop.

The most important thing we learned [through the SMR project] is the holistic approach to think resilience. Resilience has not been a familiar term, now it's becoming a familiar term, and it is how to cooperate with internal stakeholders, external stakeholders and how we all together move forward. When you work together and cooperate together, the outcome is resilient.

We are a very small city, we are only in 90,000 inhabitants, and to learn and see that other cities have similar challenges and similar obstacles due to law and leadership and politicians. It has been very good for us to know that we're not the only one. And how we can together discuss - whether or not you are big or small - discuss needs, which we have done in this SMR project, how we together can use the same tools to cope with different challenges.”



5.2 CITY OF GLASGOW – TIER 1 CITY

Interview with Gillian Dick

“Apart from being a Tier 1 city in the Smart Mature Resilience project, Glasgow is one of the three frontrunner cities [of the Connecting Nature project] along with Poznan in Poland and Genk in Belgium and we're doing something that's at a city scale, so the other two are doing community level projects, so we've put in our open space strategy and the mapping that's behind that, that we've called local context mapping. We're taking our open space mapping our quality, quantity and accessibility that we know about our blue, grey and green and we're then layering on top of that information and data we've got on flooding, on our housing, on our economic land to try and ask ourselves questions about: is the open space we've got in the right place, do we need to spend money on it to improve it if it's in the right place, or if it's in the wrong place can we do something else? Can we use it for flood alleviation, can we use it to reduce the heat in the inner city, can we use it for air quality management or can we use it to unlock development?

Glasgow is a city where 50% of the population lives within 500 metres of vacant derelict land. Dereliction makes them feel unhealthy, makes them feel sad, can add depression, can make them isolated, so can we use the data that we've got around our open space, can we use nature based solutions to improve the place that we live in?

I suppose we're also trying to look at addressing it and using it for asset management, so can we ask ourselves questions about why we've kept economic land as economic lands? When you look at Glasgow, we're a post-industrial city. We were a huge shipbuilding and industrial city, and a lot of the spaces that we use for that are alongside the River Clyde. They're in places that in any other European city you would have walkways, you would have cafes, you would have open spaces and people interacting.

The River Clyde is actually our biggest open space - it might be blue, but we've never actually planned for that river before in the last 40 odd years. We've always planned with our back to the river. So we want to plan with communities connecting into that river and using it in a better way, and some of that is about moving some of that economic land and using it either for housing or retail or open space rather than keeping it as economic land which is what we've done for the last 30 or 40 years.”



5.3 PROVINCIAL COUNCIL OF BARCELONA – TIER 4 CITY

Interview with Helena Perxacs Motgé

“I’m coming from Barcelona Provincial Government and so we are giving support to many municipalities in the province of Barcelona. Sustainability for us is a main topic for Diputació de Barcelona, and so we are very interested to join these kinds of events as the Open European Day, where we can meet other cities, other regions, other stakeholders that are also taking action on adaptation to climate change and resilience, so we can share ideas and actions and projects.

One of the projects that we are developing now it's a LIFE project which is called *CLINOMICS* and in the project we are working with the stakeholders to improve their resilience and adaptation to climate change in agriculture, forestry, fishery and tourism in different areas in Catalonia.

Here with the Open European Day, it was an opportunity to share experiences with other projects, such as the SMR project where we participated in a meeting with them and it was good to get ideas from the tools and resources they've developed during the project, and we will try to implement and to use that in our project *CLINOMICS* and to use these methodologies for the discussions with the stakeholders to increase their resilience and adaptation to climate change.”

5.4 CITY OF BRISTOL – TIER 2 CITY

Interview with Lucy Vilarkin

“It’s been brilliant working with other European cities, and particularly, we’ve got our Tier 2 city Donostia that we’ve done a lot of work with, and it’s great having the ability to build a strong peer network with our counterparts of the European cities and also to get outside of our comfort zone. You can get very locked into your own way of thinking, a very UK-centric approach, so we’ve been able to widen our perspective and understand the other challenges other European cities are going through.



It's been great working with Donostia, they're our Tier 2 City, so we've got to know a lot of the challenges they've got in their city and we've had great conversations with them and sharing our learning on resilience.

I think we're probably, on the scale of things, similar sized cities. We've got flooding challenges, Donostia has as well, so it's good to see how they're tackling those issues in their city.

When I initially came to the project it was very much about future proofing places and infrastructure. For me, the emphasis has shifted onto people and organisations, and how we deal with tackling health issues and building healthy organisations.

Coming to Open European Day, it's a great opportunity to forge closer links with other cities. Sometimes you can get lock into thinking in a particular way, say locked into a UK centric approach, and it's good to rub shoulders with other cities, which can maybe give us insights into our own city."

5.5 CITY OF THESSALONIKI – TIER 3 CITY

Interview with Deputy Mayor (name redacted)

"We as the city of Thessaloniki are very happy to be here, it's not the first time, and we were also in the event in Brussels a couple of weeks ago. We have a big interest in cooperating and forming a network with other cities which have a climate similar to the one of Thessaloniki and in order to share our experiences and our challenges because we have also some major events that happened during the last couple of weeks in Thessaloniki and in Greece in general with floods and this is a major challenge for us in order not only to alleviate the flood consequences in the city but also gain and knowledge and try to make use of this storm water that comes out from the flood for the city's benefit so we are very happy to be here to search for other cities in the South East European particular and to see how we deal with that aspect and move on forward with our agenda for the climate change and the Mayor's Adapt."

5.6 CITY OF COPENHAGEN – TIER 4 CITY

Interview with climate adaptation officer (name redacted)



“I work with the implementation of climate adaptation solutions in the city of Copenhagen and I've come to the Smart Mature Resilience Final Conference and the Open European Day to exchange experiences, to see what's going on in the rest of the world, and of course get inspiration from other people. And also because Copenhagen has moved to the implementation phase for a lot of things it's also interesting to find other cities that are also kind of moving beyond the strategic planning and actually facing the challenges but also the opportunities of actually starting to build these projects on a pretty large scale that we're doing now.

I'm interested in some of things that are going on in Scotland, I'm living there at the moment, but I think also both the sessions that I've been focusing on today are in terms of financing and the discussion around who pays for it, who gets the benefit, how do we get public sector -private sector insurance companies to collaborate and really kind of get everyone thinking about resilience in similar ways.

[A particularly interesting project I heard about] the Climate Ready Clyde project, which is in Glasgow, which I learned about through the SMR project to begin with, which ICLEI is part of and also Vejle, a Danish city, but it's also quite interesting the way that they're expanding climate adaptation and urban drainage, again, thinking outside the city but having to think in a larger regional perspective and thinking of the connections that are between cities and other public actors and it's just quite interesting to follow the work there. A lot of the governance setups are quite different from Denmark so I think it's interesting to see how things are going on in different countries and different structures and again from my perspective what's happening in Copenhagen how that's transferable or which experiences are similar and where this difference that might be kind of further explored.”

The city interviews collected at the Bonn event have been used for communication and dissemination purposes to further build the Circle of Sharing and Learning and to encourage new cities to use the European Resilience Management Guideline, including the project video.



6. AGENDA

24th April 2018

TIME	SESSION
11.00 - 12.15	Registration
12.15– 13.30	NETWORKING LUNCH
13.30 – 13.45	WELCOME and OVERVIEW OF THE PROGRAMME <i>Vasileios Latinos, ICLEI Local Governments for Sustainability</i>
13.45 – 14.45	CITY RESILIENCE PANEL – MAIN OUTCOMES OF THE SMR PROJECT AND OUTLOOK <i>Facilitator: Julia Peleikis, ICLEI Local Governments for Sustainability</i> Speakers: <ol style="list-style-type: none"> <i>Towards a European Resilience Management Guideline – lessons learnt, challenges and outlook</i> Jose M. Sarriegi, Project Coordinator, TECNUN <i>Co-creation approaches to resilience planning: Lessons from the SMR pilot implementation</i> Vasileios Latinos, Officer, Sustainable Resources, Climate and Resilience, ICLEI Local Governments for Sustainability <i>Shared insights on boosting local progress for resilience – how the cities made use of the SMR knowledge to further build local resilience</i> Pierluigi Potenza, City of Rome Judith Moreno, City of San Sebastian Silje Solvang, City of Kristiansand
14.45 - 16.00	CITY RESILIENCE SHOWCASE – INITIATIVES, PROJECTS AND TOOLS

Facilitated in-depth discussions in smaller groups, building on city experiences and their lessons learned – building on relevant questions

SMR City speakers, supported by the research partners

- Jacob Knudsen and Anne Charlotte Petersen, City of Vejle
- Lucy Vilarkin and Amy Harvey, City of Bristol
- Pierluigi Potenza, City of Rome
- Judith Moreno, City of San Sebastian
- Silje Solvang, City of Kristiansand
- Susan Howick and Colin Eden, Strathclyde Business School
- Mihoko Sakurai and Jose Julio Gonzalez, CIEM
- Jose M. Sarriegi, Marta Iturriza, TECNUN

Paired with external speakers:

- *Introduction to the AdapKIT tool*
Enrico Ponte, Risk and Resilience Expert, GeoAdaptive, City of Turin
- *Preventing flooding Risks by Making resilient communities*
Marco Cardinaletti, Project Manager, Region of Emilia-Romagna
- ***Fostering resilience. Opportunities and challenges of the local economy and society to adapt to climate change,***
Helena Perxacs Motgé, Provincial Council of Barcelona
- ***The role of smaller sized municipalities in building local resilience***
Giampaolo Tarpignati, Comune di Udine
- Decision Making Process and Resilience Assessment, Learning from New York City post Hurricane Sandy Recovery
Glen Dervishaj, Politecnico di Torino

Including Coffee Break

16.00 – 16.30 **Standardization on City Resilience Development**

Overview of standardization activities within the SMR project



Rene Lindner, Saskia Maresch, DIN

Overview of CEN/WS 92 City Resilience Development : Operational Guidance

Vasileios Latinos, ICLEI Local Governments for Sustainability

Overview of CEN/WS 88 City Resilience Development : Information Portal

Tim A. Majchrzak, Center for Integrated Emergency Management

Overview of CEN/WS 91 City Resilience Development : Maturity Model

Jose M. Sarriegi, TECNUN University of Navarra

16.30 – 18.00 **STANDARDIZATION WORKSHOPS (based on invitation)**

GROUP 1: CEN/WS 91 City Resilience Development : Maturity Model

Chairperson: *Vasileios Latinos, ICLEI Local Governments for Sustainability*

GROUP 2: CEN/WS 92 City Resilience Development : Operational Guidance

Chairperson: *Jose M. Sarriegi, TECNUN University of Navarra*

18.00 **WRAP UP and END of DAY 1**

7. PARTICIPANTS LIST

	Partner Institution	Gender	Internal/exter
1.	City of Vejle	Female	Internal
2.	ICLEI Europe	Male	Internal
3.	City of Glasgow	Female	External
4.	City of Rome	Male	Internal
5.	Strathclyde Business School	Male	Internal
6.	Linköping University	Male	Internal
7.	TECNUN	Female	Internal
8.	CIEM	Male	Internal
9.	ICLEI Europe	Male	Internal
10.	Geoadaptive Consulting	Male	External
11.	Barcelona Provincial Council		
12.	Municipality of Bratislava – Karlova	Female	External
13.	City of Vejle	Male	Internal
14.	DIN	Female	Internal
15.	DIN	Male	Internal
16.	CIEM	Male	Internal
17.	TECNUN	Female	Internal
18.	City of Donostia	Female	Internal

19.	City of Kristiansand	Female	Internal
20.	Strathclyde Business School	Female	Internal
21.	ICLEI Europe	Male	Internal
22.	ICLEI Europe	Female	Internal
23.	CIEM	Female	Internal
24.	TECNUN	Male	Internal
25.	ICLEI Europe	Female	Internal
26.	ICLEI Europe	Female	Internal
27.	ICLEI Europe	Female	Internal
28.	City of Guimaraes	Female	External
29.	City of Guimaraes	Male	External
30.	City of Thessaloniki	Female	External (tier
31.	City of Thessaloniki	Female	External
32.	City of Thessaloniki	Male	External (tier
33.	Hamburg University of Technology	Female	External
34.	Greater Manchester Combined Authority	Male	External (tier
35.	City of Athens	Female	External (tier
36.	Greater Amman Municipality	Female	External (tier
37.	LIFE/EASME Programme	Male	External
38.	City of Warsaw	Female	External
39.	ICLEI World	Female	External



40.	ICLEI World	Female	External
41.	ICLEI World	Female	External
42.	Region of Emilia Romagna	Male	External
43.	University of Bonn	Male	External
44.	City of Bristol	Female	Internal
45.	City of Bristol	Female	Internal
46.	Union of Inter-Municipal Territory of Central Friuli	Male	External
47.	University of Bonn	Male	External

ANNEX III

BONN STANDARDIZATION WORKSHOPS: MINUTES AND CLARIFICATION

SUMMARY

3rd Meeting of the CEN WS on

"City Resilience Development – Operational Guidance"

on 24 April 2018

Beginning of the meeting: 17:00 (CET)

End of the meeting: 18:20 (CET)

Workshop members have sent comments and further input on the draft CWA (document version 7). This information was merged in the new version 8 that was discussed during the web conference.

Some items that have been discussed were:

- Introduction: received comments have been discussed and directly implemented in the document. Few changes still to be done. (by ICLEI, by 23 April)
- Terms and definition (Chapter 3): check alphabetical order, coherence with other two CWAs on City Resilience Development (by DIN, by 24 April)
- Strategic governance awareness (Chapter 4): input from workshop members was discussed and text slightly updated. Few changes still to be done (by ICLEI, by 23 April)
- Operational guidance for city resilience development at local level (Chapter 5): due to time constraints only comments within subchapters 5.1-5.3 have been discussed. For example it was mentioned by Sigurd Paulsen that more explanation of how to fit the five steps (or the whole standard



in general) could be used by the city (e.g. by integrating to existing procedures of the city). Since not all comments have been addressed, Vasileios Latinos from ICLEI will ask each comment provider to give a direct suggestion for change to each comment change. This is necessary for being able to finalize the document as foreseen in May 2018. (by ICLEI, 19 April)

Next steps:

- Send request for input from partners until 19 April (by redacted)
- Receive input from partners until 23 April midday 12 CET (all partners)
- Update document until 23 April EOB (by redacted)
- Update terms and definition chapter and template until 24 April (by redacted)
- Discuss major comments in next physical meeting on 24 April (all partners)

Notes:

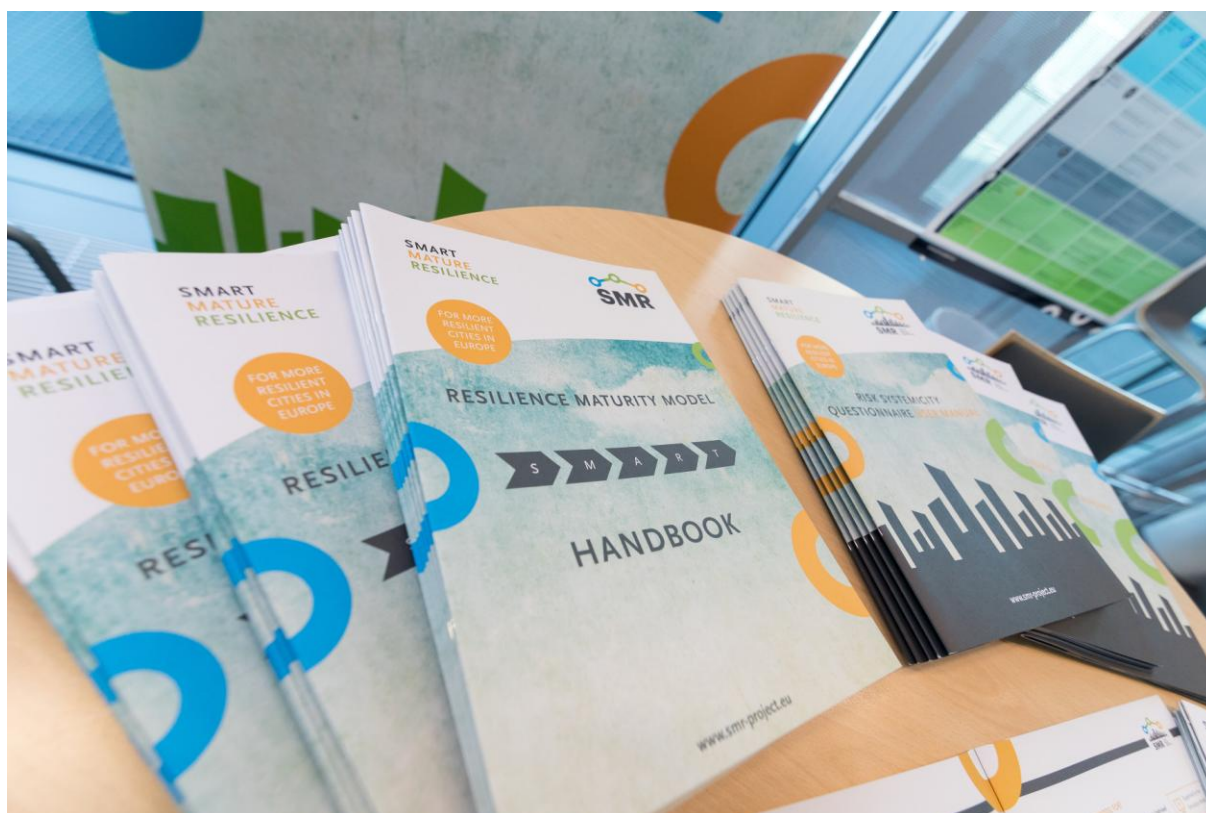
Initially it was foreseen to finalize the CWAs on 24 April. However, further requests for comments meant that the workshop team continued to improve the text after the meeting. Two parallel workshops were conducted in which we worked on the content as described in the minutes above. Further work on the CWA developments had been foreseen for May (Donostia meeting) and partly June (final web meetings and finalization of documents) in order to ensure optimal quality of the agreements.

Update: September 2018 – All three CWAs were finalized.

ANNEX IV

PROJECT SUMMARY

A final project summary was produced by ICLEI Europe with an external audience in mind for the final conference. This summary takes into account recent additions and final decisions regarding the key outputs and how to communicate them.



9.1 SMART MATURE RESILIENCE

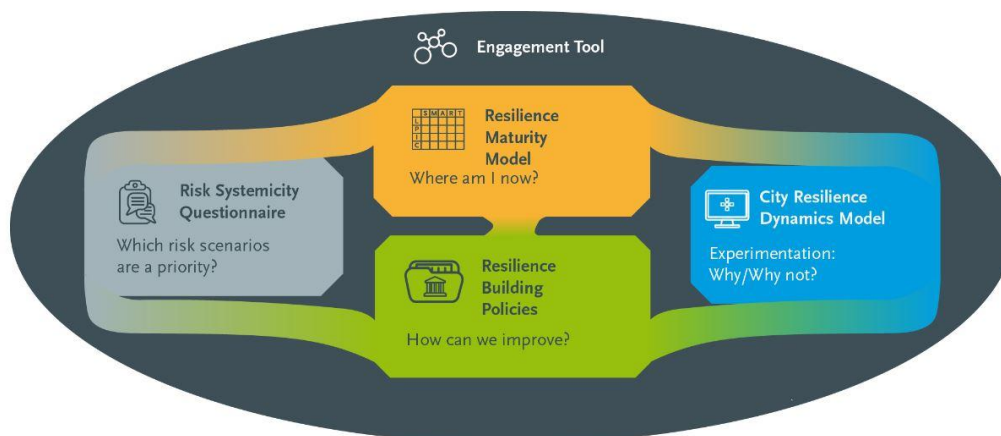
The Smart Mature Resilience project responds to the need for enhanced resilience in European cities.

SMR defines city resilience as:

“the ability of a city or region to resist, absorb, adapt to and recover from acute shocks and chronic stresses to keep critical services functioning, and to monitor and learn from on-going processes through city and cross-regional collaboration, to increase adaptive abilities and strengthen preparedness by anticipating and appropriately responding to future challenges” (Bång, Rankin 2016).

9.2 THE TOOLS

The Smart Mature Resilience project has developed five tools:



Graph 1: Resilience-building tools

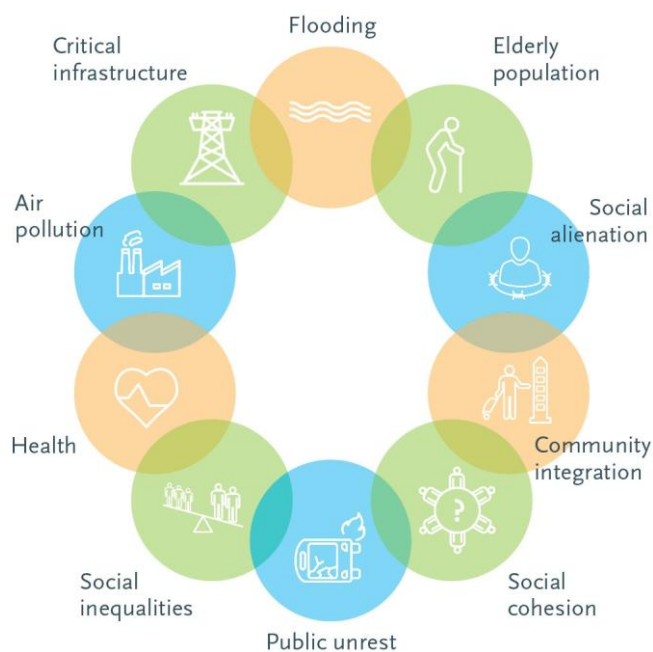
9.2.1 MATURITY MODEL

The [Resilience Maturity Model](#) (RMM) helps cities to assess their resilience status and identify the ideal path for the evolution of the resilience building process through a series of stages. The RMM aims to provide an optimum path to increase the resilience level of cities. The RMM enables assessment of a city's current resilience status and the identification of areas for improvement.

Following this initial assessment, a city uses the RMM to guide the definition of the strategy to increase their resilience level, based on the policies included in it. The RMM also provides a holistic overview of the resilience building process and helps end-users to understand resilience as a multidimensional objective.

9.2.2 RISK SYSTEMICITY QUESTIONNAIRE

The [Risk Systemicity Questionnaire](#) (RSQ) has been designed as an interactive set of questions, which city stakeholders typically complete in a group. The main purpose of the tool is to encourage focused, interdisciplinary conversations about those risks that are of greatest concern to the city. It focuses on ten risk areas:



Graph 2: *Risk topics*

These networks of risks are presented as risk scenarios, some of which result in vicious cycles. Users progress through the tool by completing questions, which ask them to consider whether defined risks scenarios are likely or not to occur in their cities. Upon completion of the RSQ, the user is presented with a prioritization, which may then be used as a focus for developing mitigation strategies.



9.2.3 RESILIENCE INFORMATION PORTAL

The [Resilience Information Portal \(RP\)](#) serves as a toolbox that can complement and enhance the platforms and software that cities already have in place. It allows cities to display data internally or publicly that is already available to the city as it applies to resilience, vulnerability and crisis situations.

9.2.4 CITY RESILIENCE DYNAMICS MODEL

The [City Resilience Dynamics Tool](#) (CRD) aims to help city disaster managers diagnose, explore and learn about the resilience building process. They can use the tool to make decisions and be able to take the correct actions in the resilience building process. The model allows the user to try different policy options, identifying the implications of each of them in the resilience improvement process.

9.2.5 RESILIENCE BUILDING POLICIES

The [Resilience Building Policies](#) (RBP) tool combines custom ways to view policies contained in the RMM with detailed information and examples from case studies detailing policy implementation in partner cities, references of sources to case studies from other cities around the world, and links to risk mitigation actions that support the policies.

The tool provides a comprehensive reference centre for strategic managers in cities and municipal workers tasked with implementing resilience building policies; provides a practical point of reference for cities considering the implementation of related policies; provides illustrative detail for the policies in the RMM and the CRD and can be navigated conveniently via a dedicated webpage that also includes a wiki format and invites cities to upload their own case studies.

9.2.6 THE EUROPEAN RESILIENCE MANAGEMENT GUIDELINE

The [European Resilience Management Guideline](#)

1. Provides guidance to cities and local governments in assessing their local resilience status;
2. Sets measurable targets together with local stakeholders, using the five tools to help the city further build local resilience and progress within the maturity stages;



3. Defines an operational framework that supports municipalities and relevant stakeholders in implementing an integrated management system that enhances city resilience and helps cities enhance their resilience maturity status

Main Users and Sectors

The European Resilience Management Guideline is primarily targeted towards:

- 1 Policy and decision makers at city level and councillors working for climate adaptation and urban resilience; also those involved in civil protection and social welfare
- 2 Other city stakeholders working on resilience in their cities, (e.g. (not limited to) critical infrastructure managers, service providers, emergency services, media, civil society associations, non-governmental organizations, academic and research institutions, consultancies)

Five Steps to Operationalise City Resilience

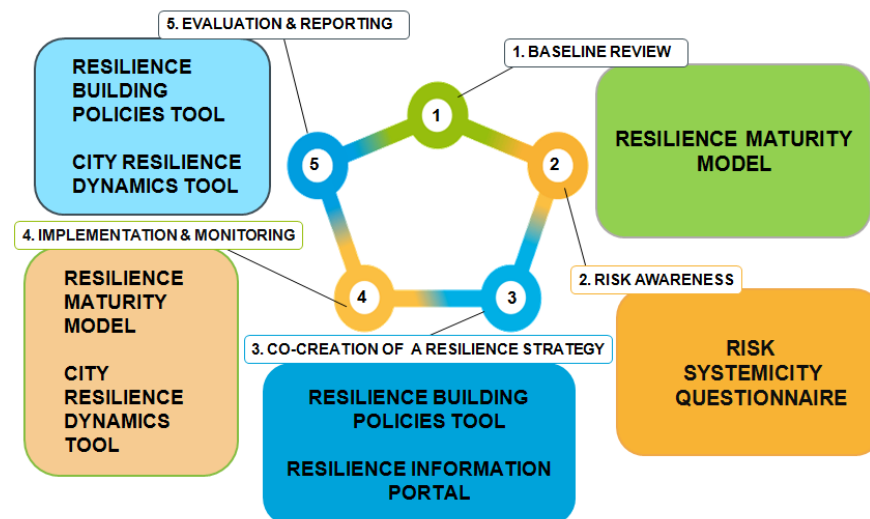
- 1 Baseline review
- 2 Risk awareness
- 3 Resilience strategy
- 4 Implementation and monitoring
- 5 Evaluation and reporting

Two crosscutting elements are required and need to be kept into mind, and perform relevant activities, throughout the steps of the cycle, and these are:

- A comprehensive and targeted organizational setup
- The continuous communication and engagement with stakeholders, including the general public



Graph 3 — the European Resilience Management Guideline



Graph 4 — Resilience tools within the European Resilience Management Guideline

9.3 THE CITIES

With the support of city network ICLEI, the tools are piloted in a group of three core cities (Glasgow, San Sebastian and Kristiansand) and reviewed and evaluated by researchers and Tier 2 cities (Rome, Bristol, Vejle and Riga) in an improvement cycle. A third group of ‘engaged’ cities receives training in the use of the finalized tools, and the tools are disseminated to ‘Tier 4’ cities.

Tier 1: Three pilot CITIES

Glasgow, Kristiansand and Donostia / San Sebastián

Tier 2: Peer-reviewer CITIES

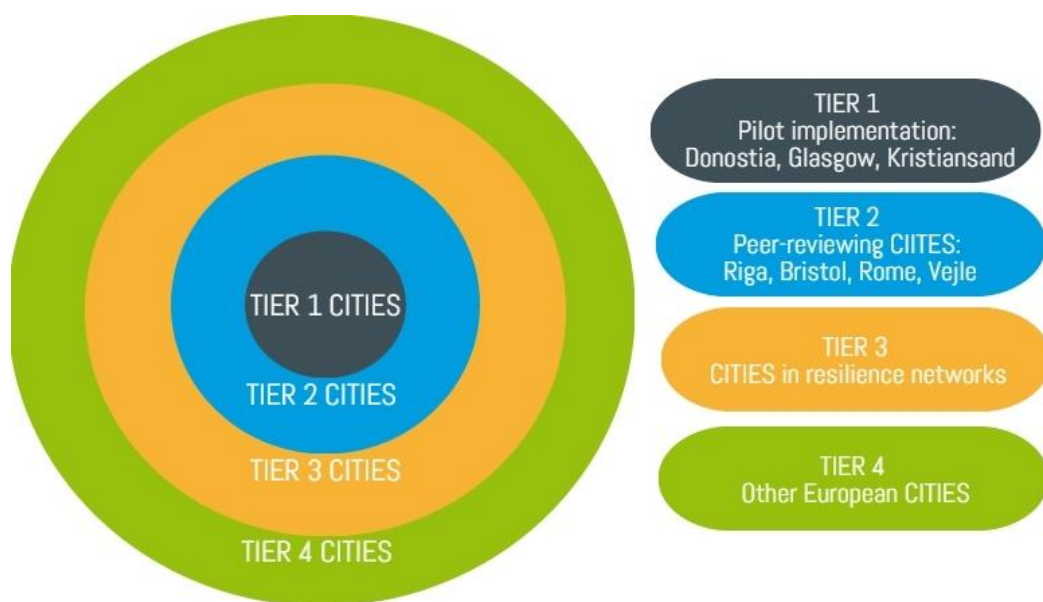
Bristol, Rome, Riga and Vejle

Tier 3: Engaged CITIES

Amman, Athens, Thessaloniki, Stirling, Malmö, Greater Manchester, Malaga and Münster

Tier 4: Informed CITIES

Alba, Barcelona Provincial Council, Municipality of Bratislava-Karova, Cagliari, Region of Emilia Romagna, Guimaraes, Larissa, London, Pavlos Melas Municipality, Prague, Potenza, Udine (on behalf of the Union of Inter-Municipal Territory of Central Friuli), Warsaw



Graph 5: *Circle of Sharing and Learning*



9.4 STANDARDISATION

Project results are prepared for exploitation through standardization processes initiated by German standardization body DIN (German Institute for Standardization). The following three CEN Workshop Agreements have been completed:

- City Resilience Development – Maturity Model
- City Resilience Development – Operational Guidance
- City Resilience Development – Information Portal

The European Resilience Management Guideline and the Resilience Maturity Model underwent significant revisions following advice from project-external participants of the standardization process. The activities included in the various operational steps of the European Resilience Management Guideline were specifically co-designed and included in each step, following consultation with participants that ensured relevance and applicability to local governments and their stakeholders across Europe. The standardization activities in the project made it possible to make the research results available to a wider public and to ensure the alignment of similar city resilience related initiatives. Currently the uptake of these standards to international level is foreseen by the ISO/TC 268 Sustainable Cities and Communities.

The CWA on Operational Guidance is the overarching document that refers to the CWA 17301, CWA 17302, as well as to other supporting tools. An overview of the standard series and some user views can be found at <http://smr-project.eu/standards/>.

FINAL CONFERENCE



ANNEX V WHITE PAPER

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

**Prepared under the Research and Technological Development
Crisis Management Topic 7 within European Commission
Horizon 2020 Secure Societies Theme**

APRIL 2018





CRITICAL INFRASTRUCTURE RESILIENCE 2018



IMPROVER



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White Paper on Resilience Management Guidelines for Critical Infrastructures.

From theory to practice by engaging end-users: concepts, interventions, tools and methods

1. INTRODUCTION

This White Paper outlines a pathway towards the integration of the European Resilience Management Guidelines (ERMG) developed as part of the work performed by five Horizon 2020 DRS-07-2014 Projects. Resilience management addresses essential capabilities for Critical Infrastructure (CI) to adapt to an uncertain future and changing environment. Targeted at policy makers, it provides an overview of essential resilience concepts, methods and techniques to attain results from these Projects and to work towards an integrated guideline which could be implemented EU wide. It presents various identified issues and opportunities surrounding a potential integration process including: resilience concepts and understanding; terminology and standardisation aspects; the core challenges in reaching full integration; complementarities as well as possible incompatibilities among the processes, methods, tools and interventions, and where future research would be beneficial towards adoption of resilience management. It presents some practical examples from the Project pilots and demonstrations of how these guidelines may be adapted and adopted by numerous target users to a variety of CIs and other domains.

2. RESILIENCE CONCEPTS AND DIFFERENT UNDERSTANDINGS

Recent years have brought numerous disasters and crises that, in hindsight, clearly demonstrate the potential benefit of more resilient CIs and social processes (Woods, 2003; Adini, et, al, 2017, Birkland, 2006; de la Torre, et al., 2012; Comfort, et al., 2010; EUROCONTROL, 2013). Examples include the SARS and H1N1 pandemic outbreaks in 2003, Hurricane Katrina in 2005, Eyjafjallajökull eruptions in 2010, Fukushima Daiichi nuclear disaster in 2011, and Hurricane Sandy in 2012. Compared to the past, these disasters challenge society in terms of dealing with the unexpected, large-scale, highly interconnected society and trans-boundary nature of events involving different countries, many private and public stakeholders and high expectations from citizens.

The changing landscape of crises which governments and societies are confronted with requires governments to adapt their approaches and capacities (Baubion, 2013). In response, resilience has the potential to address the increased complexity of today's interconnected social systems, addressing survival and even prosperity when facing challenging situations (Longstaff, 2013, BSI, 2014).⁶

⁶ The latest Global Risks Report (World Economic Forum, 2017) observes that although, in theory, greater connectivity brings intrinsic resilience, the increasing dependencies among different infrastructure networks is increasing the scope for systemic failures – whether from cyberattacks, software glitches, natural disasters or other causes – to cascade across networks and affect society in unanticipated ways”. World Economic Forum (2017). The Global Risks Report 2017 12th Edition, Insight Report, Switzerland. Available at <http://wef.ch/risks2017>

The concept of “resilience” has gained popularity, scientific articles using the term have increased exponentially in many scientific areas as show in Figure 2.1. It has been used over different research areas such as societal, organisational, urban, city, personal, human, socio-technical, ecology, and disaster research.

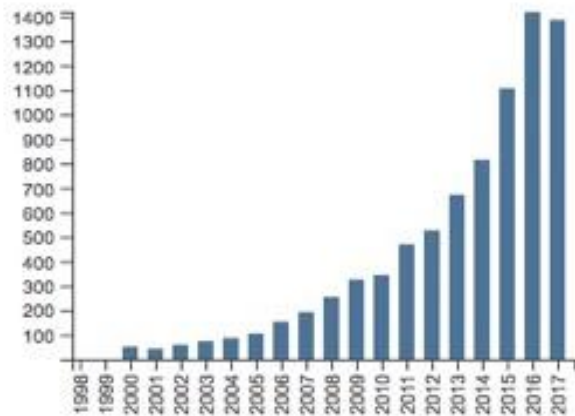


Figure 2.1. Resilience in scientific articles across CIs⁷

Hence, it is not a surprise that there is diversity, confusion, ambiguity and conflicting views on the scope and definition of “resilience”. This lack of clarity might hinder the operationalisation of resilience. To address this challenge, five H2020 European Projects have conducted world-wide literature reviews on resilience (DARWIN D1.1, 2015, RESOLUTE D2.1, 2016, SMR D1.1, 2016, IMPROVER, D1.2, 2016, RESILENS, 2015). One of these surveys identify over 300 different definitions - there are efforts to deal with these ambiguities. Survey findings show a lack of a clear definition of resilience, as well as gaps on information and understanding across agencies and CIs. It would be naïve to agree on a global definition; the different views are an invitation to remove silos and promote cross fertilisation and enrichment across domains. A possibility is to build on previous overviews and classifications of resilience understandings as illustrated in the table below (*adapted from Longstaff et al, 2013, Woods, 2015).

⁷ Prepared by Dr. Ivonne A. Herrera of DARWIN. Search for keywords: societal resilience, organisational resilience), resilience engineering, community resilience, city resilience, urban resilience and CIs Refined by categories social issues, sociology, ecology, environmental sciences, environmental studies, public environmental, public administration, occupational health, health policy services, health care services, water resources, telecommunications, transportation science technology, transportation, fisheries, multidisciplinary sciences, education scientific disciplines, management, computer science interdisciplinary applications, computer science information systems, automation and control systems, engineering manufacturing, construction building technology

Degree of Normativity Level of Complexity	Low: Descriptive	High: Normative
	Conceptual orientation: Outcome and capacity	Conceptual orientation: Process and capability
Low: Reductionism Aspect of stability: Single state Characteristics: Linearity, predictability Dominant logic: Bounce back (absorb and recover)	I Resilience as capacity to rebound and recover Elasticity (capacity to absorb) Rapidly/rate (time required to return to predefined state)	II Resilience as ability to maintain desirable state Ability to absorb perturbations Maintaining functions
High: Holism Aspect of stability: Multiple states Characteristics: Non- linearity, uncertainty Dominant logic: Bounce forward (adapt and transform)	III Capacity to extend the adaptive capacity in the face of surprise Capability to stretch when events challenge boundaries of operation Transition between states Balanced contingency between system and contexts by adjustments	IV Sustain adaptability capability to adapt and thrive Adaptive responses Dynamic process encompassing both positive and negative adaptation Capability to self-organise, adapt and learn

Table 2.1 Multiple understandings of resilience*

There is common agreement in all projects that greater focus in disaster resilience is related to bouncing back. An example is the predominant definition of resilience from the United Nations Office for Disaster Risk Reduction (UNISDR): “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”, (Cocchiglia et al., 2012).⁸

⁸ The United Nations Office for Disaster Risk Reduction (UNISDR) definition of Resilience is available at: <https://www.unisdr.org/we/inform/terminology>

This definition can be connected to resilience of low level complexity, where the system can be described with sufficient detail. The definition comes short in terms of addressing complexity, under-specification, and emergence.

We argue that the different views of resilience have direct implications on the way the system is understood and improved. In short, resilience can be seen as a capacity to adapt to challenging situations whether expected or unexpected (changes, disturbances and opportunities). It is possible to map the DRS-7 Projects addressing different resilience understandings. The IMPROVER Project emphasises the preservation of key societal functions addressing concepts related to resistance, absorption and restoration. The RESILENS Project addresses organisational resilience including prevention, protection, mitigation, analysing current and future risks, building mechanisms for infrastructure hardening and incident response planning. Thus, we can see the IMPROVER and RESILENS Projects closely related in addressing a reductionism view on resilience (two upper quadrants). The SMR Project considers urban and city resilience, defining its scope as considering processes such as collaboration between stakeholders and social engagement. This Project sees a resilient city where human vulnerability is reduced because of appropriate infrastructure and is concerned with sustainability and continuity of critical services. It addresses ability to respond, recover and deliver timely restoration of basic services (quadrant II and III). The RESOLUTE and DARWIN Project addresses a view on holism and complexity, tackling the characteristics of non-linearity and emergence. These projects acknowledge that complexity generates emergent behaviours that cannot be solely understood by analysing the individual components. These Projects address themes related to understanding everyday operation, flexibility, self-organisation, brittleness, improvisation and sources of resilience. All projects address in different ways collaboration and coordination across multiple stakeholders. The surveys indicate a low level of maturity in terms of practical implementations and many resilience-related concepts are in early stages. After these surveys, all Projects have defined specific areas where resilience-related concepts evolve towards practical applications.

At a European level, the disaster management cycle addresses prevention, preparedness, response and recovery. It has emphasis on a risk management approach addressing national risk assessment and mapping considering a multi-hazard and multi-risk approach. Risk management deals with the coordinated activities to direct and control an organisation with regards to risk. It includes different forms of actions including structural, organisation and community measures to avoid (prevention) or to limit (mitigation, preparedness and response to) adverse events. While organisations need to maintain the capacity to deal with crises using a risk management approach, innovations are required to deal with new type of crises. These innovations are not seen as a replacement but as a complement to existing capacities. Therefore, organisations need to deal with the trade-offs preparing to crisis through predefined plans and procedures to address expected situations as well as developing adaptable and flexible capabilities to prepare to unexpected situations or situations that challenge established responses. The DRS-7 Projects propose strategies, methods and tools to support resilience management. The results include evidence of their added value with respect to established methods. More details on the relation between risk and resilience management are discussed below.

All projects have collaborated with each other and with other relevant initiatives. For example, the systematic literature reviews from DRS-7 have been provided as a starting point for future Projects (e.g. DRS-14 Smart Resilience). The Projects build on international terminology, standards and policies.

On-going H2020 Projects explore possibilities to build on results from DRS-7 Projects and example is IN-PREP using results from DARWIN Project. Standardisation activities conducted within SMR Project have received contribution from other DRS7 and DRS14 Projects. At its initial stages, IMPROVER has collaborated with the now completed FP7 Project CIPRNet (CIs Preparedness and Resilience Research Network), contributing with resilience related terms to the glossary of CI protection and resilience: www.cipedia.eu.

A conclusion concerning concepts is that, as good practice, resilience and related topics need to be explicitly defined so that the scope covered by the different studies, interventions, methods, approaches and practices is clarified. Another conclusion is that today, social systems and CIs implement numerous actions to manage crises, thus there is a need to understand and enhance existing resilience in systems and organisations.

Rather than providing a unique definition, the Projects contribute to highlighting the importance and complementarity between different resilience views as a way to enhance an understanding of resilience among CIs.

3. END USER INVOLVEMENT

3.1 Target end users

As noted in the previous section, each of the Projects address different understandings of resilience and different applications of the related concepts, from a direct application to CI to various applications to societies and cities. All were undertaken at different levels. As such, the target users of the different Projects' output would be expected to vary. Nevertheless, certain commonalities can be identified between the different Project's intended stakeholder groups. These include:

- First responders which contribute to the management of the type of incidents described in the previous section;
- National, regional or local governments and civil protection agencies (often as an umbrella organisation for civilian first response organisations) with a responsibility for not only crisis management, national or regional risk assessment and planning but also for policy making on various levels;
- CI operators, including the day-to-day operators, most importantly those persons within an organisation who play a complimentary role to the persons identified above for the managing organisation; and
- The research and standardisation communities since this is a direct route for the long-term uptake and impact of the Projects results.

There are some notable differences in the stakeholder groups between the Projects. For example, RESILENS, IMPROVER and RESOLUTE explicitly target the end users of CI services as stakeholders of the Project outcomes, and SMR's alternative focus on city resilience means that the main stakeholders of the Project are in fact cities in their functional role as part of Europe in a multi-level governance perspective.

DARWIN defines three different groups of stakeholders, a primary, secondary and tertiary group of stakeholders. The primary stakeholder group includes, for the most part, the groups identified and listed above (e.g. managers, NGOs and CI operators), although the groups responsible for policy making and standardisation on various levels are included in their secondary stakeholder group. Their tertiary stakeholder group includes consultants and other actors who do not directly benefit from, but who could influence the success of, the Project's outputs.

3.2 Mechanisms for inclusion

In all five Projects, mechanisms are in place to ensure that the various stakeholders are able to contribute to the creation, adaption and adoption of the various versions of resilience management guidelines. DARWIN has its Community of Resilience and Crisis Practitioners (DCoP) which comprises 161 members from 22 countries in total who are co-creators of solutions, early adopter and potential end users of the Project results. IMPROVER has both a group of associate partners (comprising CI operators working in clusters around Europe) and the ERNCIP CI Operators network to which it has access via JRC. RESILENS, similar to IMPROVER, relies on end user Project partners (including the Water Sector in Ireland, Electricity and Municipal Government Sectors in Portugal and Transport Sector in Germany) to operationalise, evaluate and validate the Project outputs across a number of CI and public settings. Similar to the involvement of end users in the other four Project activities, partner cities in SMR have been central to the dissemination activities and implementation of their resilience management guidelines. These cities have formed a 'Circle of Sharing and Learning' with decreasing intensity of involvement and dissemination from the core circle (the three partners CITIES of Donostia/San Sebastian, Kristiansand, Glasgow) to the outer circles. In RESOLUTE has been created a User Forum composed by all city stakeholders interested in Urban resilience in general and Urban Transport System in particular has been created. The User Forum actively engages first responders, public transport operators, mobility departments, citizens, civil protection, educational institutions, etc. to incentive (big) data sharing, raise awareness and train people and operators on the ERMG and RESOLUTE technologies.

3.3 Presentation of outcomes to end users

All five Projects have undertaken continuous dissemination activities throughout their duration. This is often linked to the activities describing how the end users are involved in the creation, adaptation and adoption of the resilience management guidelines put forward by all of the Projects. All five Projects focus their dissemination activities on the specific backgrounds of the target groups addressing the potential motivation for their uptake of the Projects results. Specific techniques employed by the Projects include conferences and industry presentations, webinars, dedicated workshops, as well as experiments providing hands-on experience to engage end-users, together with educational and Continuing Professional Development (CPD) activities. All of these activities build upon the other stakeholder engagement activities with the aim of identifying key markets for the Projects and tailoring the Project outputs to these markets.

DARWIN has also included different training formats including a curriculum Master course for professionals, power point presentations, use of Emergo Train System, use of serious games such as

DARWIN Resilience Training for Operational Capabilities and a DARWIN serious game based on virtual reality (last one's prototypes).

Specific activities of the RESILENS Project include the development of the 'RESILENS Decision Support Platform' (RES-DSP), the RESILENS tools, incorporating a Resilience Management Matrix and Audit Toolkit (ReMMAT), an e-Learning Hub and a Concept of Operations (CONOPS) Approach.

SMR has implemented its tools in the seven city partners of the project and has implemented three additional regional clusters in Scandinavia, Spain and Greece to foster the use of the tools in more cities. IMPROVER collaborates with the European Commission's European Reference Network for CI Protection (ERNICIP, <https://erncip-project.jrc.ec.europa.eu>). Together, the two Projects co-organise a series of CI operators workshops on CI resilience to ensure that practitioners both inform and benefit from the work of IMPROVER on resilience (IMPROVER D1.4, 2016; D1.5, 2018).

Each of the Projects have a specific exploitation strategy which addresses individually the objective of encouraging uptake of the Projects' results by target users.

3.4 Key themes and synergies

Key themes in terms of stakeholder engagement in the different Projects include a targeting of CI operators, not only in the dissemination strategies of the different Projects but also in the actual development of the Project results. This is achieved largely through the inclusion of end users as participants either in the consortia or in workshops and other activities throughout the Projects and specifically in the final pilot implementations of the Projects' results.

Stakeholder surveys have been conducted by the Projects. For example, surveys were conducted at different stages, ensuring to meet user needs and expectations. This work has led to the identification of ten themes requiring improvements in terms of resilience management with the DARWIN Project (DARWIN D2.2 and D2.3):

SUPPORTING COORDINATION AND SYNCHRONISATION OF DISTRIBUTED OPERATIONS: 1 -Promoting common ground in cross-organisational collaboration; 2 - Establishing networks for promoting inter-organisational collaboration; 3 - Ensuring that actors involved in resilience management have a clear understanding of their responsibilities and the responsibilities of other involved actors;

MANAGING ADAPTIVE CAPACITY: 4 - Enhancing the capacity to adapt to both expected and unexpected situations; 5 -Establishing the capacity for adapting during crises and other events that challenge normal plans and procedures;

ASSESSING RESILIENCE: 6 -Identifying sources of resilience; 7 - Noticing brittleness; 8 - Assessing community resilience to understand and develop its capacity to manage crises;

DEVELOPING AND REVISING PROCEDURES AND CHECKLISTS: 9 - Managing policies involving systematically – policy makers and operational personnel for dealing with emergencies and disruptions;

INVOLVING THE PUBLIC IN RESILIENCE MANAGEMENT: 10 - Interacting with the public not yet affected by or involved in a crisis.

In addition to this end user involvement, all five Projects have identified the need to target policy makers either in the EU or in the individual Member States as stakeholders for the Projects' results. This is important as the long-term uptake of the concept of CI resilience relies on its adoption not only in CI, but also in national and international crisis planning and management activities (IMPROVER D5.1).

All five Projects have contributed to various activities together, attempting to achieve a synergy in terms of certain dissemination and communication activities. Shared events have been held and certain Projects have contributed to events held by some of the other Projects. Importantly, there seems to be significant overlap in terms of a focus on dissemination to stakeholders who will directly benefit from the Projects' results as opposed to dissemination via academic or research focussed industries.

4. INTERVENTIONS, TOOLS AND BENEFITS

This section provides an overview of the key Project outputs of the DRS-7 Projects. Each Project output has been classified into 8 categories: definition, strategy, analysis, evaluation, training, implementation, simulation, and other.

Definition:

- E-Learning Hub (RESILENS): An interactive platform containing e-learning resources and repository of supporting documentation, to support academic and vocational learning and CPD.
- Terminology (DARWIN): It describes terms used in the resilience management guidelines. Definitions come from standards or literature, references are included.
- Lexicon (IMPROVER): The IMPROVER lexicon has evolved over the course of the Project, with a draft presented at the end of the first year following completion of the international survey. A final version was delivered half way through the Project. 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.
- Semantic Aware Taxonomy (RESOLUTE): the terms used in the project have been managed through a dedicated tool (SIDOC) where lemmas are disambiguated, semantically connected with other lemmas and then reused for buildings indicators. Thus, SIDOC tool supports a collaborative, consensus driven and not ambiguous common language and indicators definition.

Strategy:

- RMM (Resilience Maturity Model), (SMR): The RMM is a strategic tool that provides an ideal roadmap for how the resilience building process should be. It enables the identification of areas that have to be improved in each city, related to policymaking and planning. This tool also helps to enhance the communication among stakeholders which increases their awareness, engagement and commitment on the resilience building process.
- Method to adapt guidelines to specific CI (DARWIN): Method to adapt resilience concept to specific domains. It consists of two main phase assessments of adaptability of the generic

resilience concepts and adaptation of concepts to specific domains. The Project presents adaptation of resilience concepts to two domains such as air traffic management and health care.

- ERMG - European Resilience Management Guidelines (RESILENS): It provides a comprehensive guide to measuring and understanding the resilience of individual and interconnected CI systems, through a series of structured sections that address the key concerns and considerations through an ongoing and iterative process. The guide promotes greater flexibility, foresight, organisational learning and collaboration.
- ERMG - European Resilience Management Guidelines (RESOLUTE): it provides a number of guidelines with the aim improving the ability to cope with system performance variability, through the dampening and management of its operational impacts. In particular, a FRAM-based (Functional Resonance Analysis Method) “desired” model is provided, and for each function and interdependences identified a number of recommendations to dampen functional variability are identified. For each function in the model are reported general recommendations, common performance condition (CPC) – based recommendations, interdependencies management recommendations, real word examples, references. The ERMG aims at supporting a self-evaluated multilevel gap analysis in respect to the state of the affairs of the CI considered (D3.5 European Resilience Management guidelines, 2016).
- ERMG – UTS (Urban Transportation Systems) (RESOLUTE): it provides an adaptation of the ERMG that are generic of the all the transport infrastructures, to the UTS case.

Analysis:

- Triggering questions associated with resilience concepts (DARWIN): The DARWIN Resilience Management Guidelines (DRMG) are developed around the concept cards (CC) which represent sets of interventions including triggering questions proposed in order to develop and enhance specific resilience management capabilities
- Critical Infrastructure Resilience Index (CIRI) – (IMPROVER): It is a holistic, easy-to-use and computable methodology for analysing and assessing resilience which is based on other existing methodologies – e.g. the Repair & Maintenance, Inc. (RMI) developed by Argon labs in the US or the methodology developed by the Italian association of CI operators. It has been developed with a focus on the crisis management cycle and incorporates multiple domains of resilience. The methodology is applicable to all types of CI, including a possibility to tailor it to the specific needs of different sectors, facilities and hazard scenarios. The proposed methodology is especially suitable for organisational and technological resilience evaluation but also permits elements of societal resilience indicators in the evaluations.
- IMPROVER Technological Resilience Analysis (ITRA) – IMPROVER Technological Resilience Analysis (IMPROVER): ITRA combines a performance loss and recovery function, which indicates long term recovery for a given infrastructure, with an emergency response model which is used to determine the short-term recovery. Using this approach interdependencies can be identified and their impact on the recovery can be accounted for. Using the emergency response model also helps to priorities different recovery operations which can improve the overall ability of the infrastructure to adapt in the short term and to provide an immediate minimum functionality. Finally, the emergency response model also helps to identify the role of first responders in contributing to the resilience of CI.

- IMPROVER Organisational Resilience Analysis (IORA) – (IMPROVER): The IORA is a narrative based methodology for analysing organisational resilience. The purpose of the analysis is to promote resilient performance. This is based on identifying a hierarchy of functions, forms and processes which contribute to this purpose. The IORA process requires collection and processing of information about how an organisation's processes contribute to this. Within the IMPROVER Project this is done via in-depth interviews based on narratives of historical events. Functions, forms and processes during this event form the basis for the analysis and the subsequent evaluation.
- IMPROVER Societal Resilience Analysis (ISRA) - (IMPROVER). ISRA is a methodology structured similarly to CIRI which focusses on societal resilience. It focusses on different social capitals, and includes the results of CI resilience assessment as part of a societies physical capita
- Quantified Functional Resonance Analysis Method (RESOLUTE)- Q-FRAM aims at extending the expressiveness of FRAM approach formalising the methodology and connecting (Big) data related to each function in the model to quantify variability and system resonance (Bellini et al. 2017; Bellini, Nesi Ferreira, 2016; Bellini et al 2016).

Evaluation:

- Risk Systemicity Questionnaire (RSQ) - (SMR): It is an Excel based tool where users are asked to consider the relative likelihood of a broad range of risks in their cities. These risks are spread across ten topics and are considered as networks of interrelated risks. These networks of risks are presented as risk scenarios, some of which result in vicious cycles. Users progress through the tool by completing questions.
- Evaluation method (cases) pilot trial (DARWIN): Pilot cases provide evidence of potential benefits of the guidelines. It combines a quantitative and qualitative evaluation assessment.
- ReMMAT - Resilience Management Matrix and Audit Toolkit (RESILENS): ReMMAT is designed to help CI operators have a better understanding of how resilient their entities are to potential disruptions (man-made or natural). ReMMAT allows CI operators to quantitatively score the resilience of their entities, assets or systems and provides a platform for them to qualitatively assess strategies that can be put in place to improve resilience.
- Criteria for evaluation of CI resilience (IMPROVER): The evaluation criteria for CI resilience in IMPROVER are based on user needs, physical needs or needs built into legislation, or on user tolerances. A methodology has been developed for elaborating these evaluation criteria in a way that they can be compared with the results of an analysis carried out using ITRA to inform engineering decision making.
- The system resilience is assessed through a FRAM-Driven approach, where a number of Key Performance Indicators (KPIs) has been identified for each function of the system. These KPIs are valorised through a mixed approach of expert judgment/data analysis. Synthetic indicators have been also defined to quantify the variability in the system related to each of the 4 resilience capacities: anticipate, respond, monitor, learn.

Training:

- Training material for operational resilience (DARWIN, prototype): D-TORC is a game-based training for operational resilience capabilities. It can be applied to specific DRMG Concept

Cards (CCs) and the scenarios. It includes operational, managerial and integrated training arenas.

- Academic course on resilience management (DARWIN): It was written by content experts in both arenas of disaster resilience, as well as in the field of academic teaching. Each module includes relevant CCs according to the DARWIN Project, an abstract describing the summary of the module, and learning outcomes.
- Serious game using virtual reality (DARWIN, prototype): Players conduct exercises to improve their understanding of the DARWIN resilience concepts, and to have memorable experiences that are beneficial in real crises. These exercises should present the main concepts, constraints, and guidelines so everyone involved in a large crisis has a better understanding and course of action. It is aimed to be an entertaining medium to introduce anyone to the DARWIN guidelines.
- E-Learning Hub (RESILENS): An interactive platform containing e-learning resources and a repository of supporting documentation, to support academic and vocational learning and CPD.
- Game-Based Training App (RESOLUTE): It is a tool to improve the preparation of citizens. It is motivated by its teaching potential: interactive, engaging and immersive. The learning is happening due to intrinsic motivation to play. Game-based learning has become an optimal training tool for soft skills development since it fulfils the following five criteria: Compelling content; Clear emphasis on practical application; Interactivity and experimentation; Genuine skills development through practice and feedback; Motivation for people to learn and, above all, to complete the course they begin.
- CI Resilience training material (IMPROVER): The training material from IMPROVER is currently under development, and includes a series of modules on the themes of: Introduction to resilience; the Improver CI REsilience Framework (ICI-REF); Technological resilience concepts and their implementation to CI (ITRA); Organisational resilience concepts and their implementation to CI (IORA); Holistic resilience assessment using the CIRI; Societal resilience concepts and their implementation to CI (ISRA); Implementation of resilience concepts (could also include e.g. expert elicitation and scenarios); and finally resilience evaluation and treatment. This training material will be made available on the IMPROVER website when it is finalised.

Implementation:

- Resilience Policies Tool (SMR): It is an extension of the online version of the RMM. It combines custom ways to view policies contained in the RMM with detailed information and examples from initiatives identified in the RSQ as well as case studies from SMR cities and further details from scientific literature. It is adaptable and interactive through the SMR Policy Wiki, where cities can request login details to contribute their own case studies to the tool.
- Resilience Information and Communication Portal (SMR): It serves as a toolbox that can complement and enhance the platforms and software that cities already have in place. It allows cities to display data internally or publicly that are already available to the city as it applies to resilience, vulnerability and crisis situations. The portal allows for different levels of users to allow for city managers, CI providers, citizens or other stakeholders to be able to contribute information as applies to a given city context.

- **DARWIN Wiki (DARWIN):** A DARWIN Wiki platform has been used to develop and manage the guidelines. The content is the result of co-creation between DARWIN partners and members of the DARWIN resilience and crisis community of practitioners.
- **Critical Infrastructure Resilience Management Framework (ICI-REF) - (IMPROVER):** The ICI-REF is a framework which lays out the relationship between CI risk management and CI resilience management. It formalises the steps needed to undertake a CI resilience assessment and describes where various tools could fit into this. The intention with the ICI-REF is that it could also take advantage of other Project outputs and methodologies to enrich the risk management process with information about resilience.
- **Societal Resilience Management Framework (IS-REF) - (IMPROVER):** The IS-REF is a framework similar to the ICI-REF, which enriches societal risk assessment with the results of resilience assessment.
- **Collaborative Resilience Assessment and Management Support System – (CRAMSS) - (RESOLUTE).** The CRAMSS is primarily a concept or an idea of a collaborative workspace in which DSS operators can share their outputs of or information about their operations among each other. Thus, the CRAMSS is a frame to gather, integrate, analyse and display information from separate legacy systems or Decision Support Systems (DSS) managed by different operators (e.g. mobility managers, civil protections, fire brigade). The CRAMSS consists of a backend that establish a bi-directional communication environment and it is built up on a Big Data layer that collects and fuse heterogeneous data from a sensorised urban environment and makes them available through dedicated APIS for further analysis. The CRAMSS is also composed by:
 - **Resilience Dashboard:** it supports reference actors at the UTS, such as infrastructure managers, with their decision making under both, standard operating conditions and emergency conditions displaying in real-time information from different sources such as: car accidents, presence of the people in city areas, etc.;
 - **Evacuation DSS:** The eDSS supports a quick and effective evacuation of the civilians taking into account how safe spots or paths may change with continuously evaluation of the situation exploiting the data in collected in real time by the Big Data layer;
 - **Resilience DS:** it allows the modelling of a complex system according to the FRAM approach. The tool supports the connection of the FRAM model with data collected by the Big Data Layer and formalise the variability propagation through a Tree Value Logic decision tree.
- **Emergency Mobile App (ESSMA) - (RESOLUTE):** ESSMA aims to assist the resilience of a community keeping civilians updated and guided for their reactions under danger situations. The main objective of the ESSMA application is to give the opportunity to civilians to be aware of emergencies and to know the most appropriate way to take in order to be safe.

Simulation:

- **City Resilience Dynamics Tool (SMR):** It is an online serious game, which represents the evolution of the City Resilience, depending on the policies cities implement. The simulation model allows the cities to understand the precedence relationship of the policies included in the RMM. It also provides the possibility of calibrating the model to every city particular characteristics.

- Discrete Event Simulation tool for specific situations (DARWIN): It is specifically tailored for a DARWIN scenario. The simulation supports the domain expert in assessing a particular strategy of resource deployment or the implications of a particular set of initial conditions.
- RES-DSP (RESILENS Decision Support Platform) (RESILENS): The RESILENS tools will be hosted on an interactive platform that allows users to access the guidelines and associated tools.

Others:

- Stakeholder analysis (DARWIN): This questionnaire is used to identify individuals, groups and organisations that are affected directly or indirectly by the resilience guidelines. It also identifies needs, priorities, barriers as well as opportunities for implementation of the guidelines.
- Association of European Schools of Planning (AESOP) Communication guidelines for CI operations (IMPROVER): Communication guidelines for CI operators to improve their interaction with communities, creating a sense of shared ownership with regards to the capabilities of CI in the event of a crisis.
- IMPROVER Web based resilience analysis tool (IMPROVER): this is a tool which is intended to facilitate the completion of indicator-based analyses, such as CIRI or ISRA.

5. POLICY, STANDARISATION AND CURRENT NEEDS

Policy

Context

The concept of Resilience has been reflected in recent EU policies with increasing rate and in various priorities. The EU has been working in various areas that aim in improving the Resilience of the Members States. Examples include the Digital Single Market⁹, the European Security Agenda¹⁰, the Joint Framework on countering hybrid threats¹¹, the Joint Communication on Resilience, Deterrence and Defence: Building strong cybersecurity for the EU¹² and the Communication on Launching the European Defence Fund¹³. Such recent policies indicate a shift from a reactive to a proactive approach.

While Member States remain responsible for national security, the scale and cross-border nature of the threats, such as cyber-attacks or hybrid threats, make a powerful case for EU action providing incentives and support for Member States to develop and maintain more and better national

⁹ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions 'A Digital Single Market Strategy for Europe', COM (2015) 0192 final, Brussels, 6.5.2015

¹⁰ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, 'The European Agenda on Security', COM (2015) 185 final, 28.4.2015.

¹¹ Joint Communication to the European Parliament and the Council 'Framework on countering hybrid threats a European Union response', JOIN/2016/018 final, Brussels, 6.4.2016

¹² Joint Communication to the European Parliament and the Council 'Resilience, Deterrence and Defence: Building strong cybersecurity for the EU', JOIN (2017) 450 final, Brussels, 13.9.2017

¹³ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions 'Launching the European Defence Fund', COM (2017) 295 final, Brussels, 7.6.2017

capabilities, while at the same time building EU-level capacity. This approach is designed to galvanise all actors – the EU, Member States, industry and individuals – to build resilience.

Moreover, the EU Global Strategy for EU Foreign and Security policy elaborated the need for an integrated approach to link internal resilience with EU's external actions and called for synergies between defence policy and policies covering the internal market, industry, law enforcement and intelligence services.

The EU is already working under Horizon 2020 to develop a sound evidence base to strengthen resilience, in various areas such as:

- Climate Adaptation;
- Civil Protection;
- CI Protection;
- Cyber-Security;
- Security of critical transport infrastructure; or
- Energy security.

Policy recommendations arising

Based on the experience and findings of the Projects, focusing especially on CI (CI) resilience, it is proposed that:

- 1) The paradigm shift from protection to resilience would be reflected more in the EU/Member States policy documents;
- 2) The recommended direction in the EU/Member States would be to move from mere risk assessment/management towards resilience management, that is, focusing more on recovery capabilities (without losing the efforts to enhance prevention and preparedness); and
- 3) The EU/Member States should develop a strategy on how to balance between regulation and voluntary efforts by the private CI operators to enhance CI resilience.

Below follows a more detailed argumentation for the above policy objectives.

1) From protection to resilience

Although the concept of resilience has deep roots in many disciplines, in its contemporary meaning it may be appropriate to trace it back to the ecological debates of the early 1970s. The concept was popularised in unofficial policy and scientific analyses in the mid-2000s in the context of crisis and disaster management. Before long, it also entered the academic field of, for instance, CI studies, replacing the earlier focus on protection.

After some years, this paradigm shift became visible at the policy level as well, first and foremost in the US. As was the case with the concept of CI Protection (CIP), the EU followed the same trajectory after lagging behind for some years. While the concept of resilience was not even mentioned when EPCIP, the European Programme for Critical Infrastructure Protection, was launched in 2005-2008, in the 2012 Commission review of EPCIP it already plays a role, albeit a small one. As an alternative concept to protection, resilience didn't start to appear in the EC institutions in earnest until about 2014. The more recent Network and Information Systems (NIS) Directive (2016) reflects such a change as among its key objectives is to ensure the continuity of essential services against incidents affecting the security of the network and information systems used for the provision of such essential services¹⁴.

¹⁴ Directive (EU) 2016/1148 of the European Parliament and of the Council of 6 July 2016 concerning measures for a high common level of security of network and information systems across the Union.

This development reflects the acknowledgment that complete protection can never be guaranteed, and that achieving the desired level of protection is not cost-effective as a rule in relation to the actual threats.

The exact boundaries of the resilience discourse in the context of CI or vital societal functions remains still rather blurred. Nevertheless, certain sub-discourses have emerged, and have even become institutionalised. Consequently, we can differentiate between at least three separate, albeit partially overlapping domains of CI resilience that show potential for policy change: organisational, technological and societal. When defining the CI resilience domain, in principle we can approach the issue from the perspective of the organisations or institutions that are in charge of taking the appropriate actions before, during or after a harmful and unwanted event affecting CI service provision. In organisational resilience, the actors are the businesses, especially those responsible for CI and supply chains, i.e. CI operators or operators of essential services. In technological resilience, the actors include CI systems and the respective facility operators, and, to some extent, safety and security manufacturers and vendors. In societal resilience, the important actors are national and local governments, communities and households, and it is in these contexts that CI resilience often overlaps with normal civil protection or crisis management efforts. This is where CI resilience also links to city resilience.

For example, on the EU level, the EU “Adaptation Strategy to Climate Change”¹⁵ formed a turning point in the understanding of the concept of resilience within the EU. It also acknowledged the essential role played by infrastructures and the need for climate-proofing. The concept of city resilience is wide and covers CIs, climate change, but also social dynamics. It still lacks widespread operationalisation and is only partially reflected in relevant policies. Challenges to be addressed are among others the engagement of multiple stakeholders with conflicting priorities and objectives, but also financial, practical, political, reputational, or other opportunities and constraints that the cities need to take into account when developing resilience strategies. Some examples on how cities are currently using public policy to integrate resilience thinking into their activities have been identified by the 100 resilient cities initiative¹⁶, in the three areas, namely Project design, land use planning, and budgeting and capital planning. Another institutional change can be the formalisation of the Chief Risk Officer (CRO).

2) From risk management to resilience management

The approaches of resilience assessment and management are overlapping with, and indeed a more generic concept than, risk assessment and management. While risk assessment is commonplace in corporations, most governments also carry out risk assessments. In recent years, in Europe risk assessment has become more important in such fields as civil protection and emergency planning. In the context of the Union Civil Protection Mechanism (UCPM)¹⁷, most European and neighboring

¹⁵ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions ‘An EU Strategy on adaptation to climate change’, COM (2013) 216 final, Brussels, 16.4.2013

¹⁶ <https://www.100resilientcities.org/cities-changing-policy-trends-developing-urban-resilience/>

¹⁷ Decision No 1313/2013/EU of the European Parliament and of the Council of 17 December 2013 on a Union Civil Protection Mechanism Text with EEA relevance

countries¹⁸ have prepared National Risk Assessments (NRAs), generally following guidelines provided by the European Commission¹⁹. These guidelines follow closely the ISO 31000 family of standards.²⁰

The European Commission has summarised these NRAs into an overall overview of risks, emphasising risks that are shared by many countries, in 2014 and in 2017.²¹ Since 2013, Member States have committed to produce a new or updated national risk assessment every three years, starting from December 2015²². NRAs identify and assess the natural and man-made disaster risks which would, if faced, require a response at a national or supra-national level. According to the overview of risks published in 2017, “disaster risk types range from meteorological (flooding, extreme weather), climatological (forest fire, drought), geo-physical (earthquake, landslide, volcano) and biological (pandemic, epizootic, animal and plant diseases) natural disaster risks, to non-malicious man-made disaster risks of technological origin (industrial accident, radiological accident, CI disruption), and malicious man-made disaster risks and security threats (cybercrime, terrorism) closely associated with the European Agenda on Security”.²³ Finally, in collaboration with participating states, the European Commission has developed guidelines for the assessment of risk management capability (Commission Notice 2015/C 261/03).²⁴ Participating states must complete an assessment of their risk management capability by August 2018.

Should resilience become the dominant paradigm and strategy, this would basically entail the need of moving from the current (national, local, CI operator and facility-based) risk assessment/management toward resilience assessment/management when it comes to CI or, more generally, vital societal functions or essential services. In practice, this would mean clearly adding the recovery factor and respective preparatory issues to the risk management approach (risk assessment, prevention, and to some extent preparedness). The difference is that the occurrence of a crisis is assumed.

But how should resilience management be carried out? While in the field of risk management one can find several standards and best practices, there are no standards when it comes to performing resilience management. How do we know whether a CI (or any entity or community) is resilient or not? Can resilience be measured? How can it be enhanced?

In fact, a number of models do exist, some of which are only theoretical applications while others are already in operational use and designed for resilience assessment. No such models are in operative use in Europe, however. This is the issue that the current Project(s) have dealt with. The results include blueprints of resilience assessment and, to a lesser extent, management models.

¹⁸ These include across the EU 28 Member States and the six non-EU countries participating in the UCPM (Iceland, Norway, Serbia, Montenegro, former Yugoslav Republic of Macedonia, and Turkey).

¹⁹ Commission Staff Working Paper, 'Risk Assessment and Mapping Guidelines for Disaster Management', SEC (2010)1626 final, 21.12.2010

²⁰ <https://www.iso.org/iso-31000-risk-management.html>

²¹ Commission Staff Working Document on Overview of Natural and Man-made Disaster Risks in the EU, SWD (2014) 134 final, Brussels, 8.4.2014

Commission Staff Working Document on Overview of Natural and Man-made Disaster Risks the European Union may face, SWD (2017) 176 final, Brussels, 23.5.2017

²² Decision No 1313/2013/EU of the European Parliament and of the Council of 17 December 2013 on a Union Civil Protection Mechanism Text with EEA relevance.

²³ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, 'The European Agenda on Security', COM (2015) 185 final, 28.4.2015.

²⁴ Commission Notice 2015/C 261/03 - Risk Management Capability Assessment Guidelines, 8.8.2015.

Resilience is already being explored within international and European standardisation levels. Some of the DRS-7 Projects are working towards *Comité Européen de Normalisation*/European Committee for Standardisation (CEN) Workshop Agreements (see section on Standardisation). In the field of CIs, the working groups of the ERNCIP Project could also be a means to perform pre-normative research that could inform such standardisation processes at a later stage.

3) Regulation or public-private partnership?

So where do private actors fit into the picture? This is an important question when it comes to CI in particular. Governments are usually legally responsible for safeguarding CI, and yet most of it is owned, administered and operated by the private sector. This is why public-private partnership (PPP) is regarded as a major issue in safeguarding national infrastructure.

While in the United States, private industry traditionally owns most of what is defined as national infrastructure (its share being estimated at 85 per cent),²⁵ in many European countries infrastructures such as water, energy, and railway transportation have previously been the sole remit of the government.

The rapid development of the predominantly privately owned and operated information and communication technology sector, and other sectors' dependence on it, has complicated the situation. This, coupled with other CI interdependencies, has led to a rather ambiguous situation in terms of the real authority, as government authorities may have, either formally or informally, overall responsibility for the reliable provision of services, but they lack the authority, resources and skills to actually fulfil that responsibility.

Hence, private industry is supposed to be able to exert extensive self-regulation because, in practice, only they have access to the necessary technical capabilities and information pertaining to most of the CI.

Added to this, globalisation, with its tendency to move private companies outside the nation state, has made the situation more complex from the perspective of government control. The fact that national CI are dependent not only on other sectors but on the situation in other countries complicates the situation because no single country is either immune to the effects, or able to predict the outcomes, if its neighbours suffering from serious CI disruptions.

Here we face the dilemma of the common good. Some have proposed that the solution lies in the concept and practice of Corporate Social Responsibility (CSR). However, while CSR and PPP may seem self-evident and are celebrated by all parties, this shallow consensus is usually broken when it becomes clear that governments expect the private sector to make considerable investments beyond their cost-benefit calculations. Thus, this dilemma leaves governments with only two options: to provide the necessary resources itself, funded out of the public budget, or to increase regulation.

In the US, the approach is clearly based on voluntary private sector cooperation with the federal government. This is largely due to the country's anti-regulation traditions, and the private sector's willingness to do their share precisely in order to avoid regulation. Compared with the US, the EU approach, referring to national rather than EU legislation, seems to mark a step towards regulative efforts instead of mere voluntary compliance, although both the US and the EU put emphasis on the importance of PPP.

²⁵ Government Accountability Office, The Department of Homeland Security's (DHS) CI Protection Cost-Benefit Report, June 26, 2009.

None of the EU Member States has thus far arrived at any clear solution to this dilemma. Undeniably, CI operators usually do prepare all kinds of regulatory and voluntary risk assessments, but the regulation is rather light, and often outdated. The field of cyber security, for instance, is for the most part owned by the private sector and companies tend to follow commercial logic, which creates a challenge for cyber security preparedness. The implementation of the NIS Directive tries to ensure a minimum level of security for operators of essential services.

There is, of course, rather detailed regulation in all countries related in particular to so-called high-risk industries, such as nuclear power plants, as well as organisations connected to critical public services, such as hospitals. They should have updated risk assessments as well as the respective capacities and capabilities, which are monitored in principle by certain independent state or municipal agencies. In many privately-owned CI cases, however, this regulation is also rather vague from the perspective of resilience.

Adding regulation would force the private sector to invest more resources in dealing with the protection or resilience of the systems they own or operate. This would be an unwelcome change for many CI operators because markets are externalising CI risks at present, whereas state regulation would mean establishing liability rules based on the notion that organisations should internalise the costs of the risks they produce and that by internalising them, they will make wiser choices about the technologies they use. This in essence would necessitate a well-functioning tort liability legislation, which would make it easy for consumers, both public and private, to subsequently demand compensation for losses incurred by CI failures, which in turn would force industry to pay more pre-emptive attention to security and protection out of self-interest.

In any case, the issue demands a solution. Again, the existing ERNCIP might become a part solution, providing a pilot case, based on its established series of “CI Operators Workshops”. While the EU might be too large to be involved to develop best practices, such entities as the Nordic countries or another selected group of countries (organised in sectorial CI operators and authorities’ cooperation, such as energy and transport) could test different voluntary solutions, at least.

Standardisation – needs and potentials

This section gives an overview of the standardisation activities of the SMR, RESOLUTE and DARWIN Project. The process on how to identify standardisation potentials, the development of a standardisation strategy of the SMR and DARWIN Project are described. All three research 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.

Identification of Standardisations Potentials

In order for the SMR Project to identify standardisation potentials; existing standards and ongoing standardisation activities were identified and assessed. The so called ‘supply side’ is the amount of existing standards and ongoing standardisation activities as well as the developed results out of the SMR Project.

However, developed solutions can only be transferred into standards, if the stakeholders identify a matching need for these solutions. In this regard a survey and several standardisation sessions were conducted in order to receive the stakeholder's point of view and to assess their needs. These activities have been summarised as the 'demand side'. The survey consisted of 10 questions and was answered by city representatives from Bristol, Glasgow, Kristiansand, Riga, Rome San Sebastian and Vejle. The following four questions give an insight into the survey and the given answers:

What are your needs regarding new Standards?

- Steps on how to build a robust cross-sectorial and holistic collaboration in the city;
- Simplify cross-sectorial cooperation;
- Guidance on the creation of a responsive structure within the city which embeds resilience-building and breaks down sectoral boundaries;
- Clear and transparent action plan which will not increase bureaucracy;
- Standards who help create the breathing space (avoid being overly prescriptive).

What should be part of a standard on resilience management?

- Description on the difference between risk management and resilience management;
- Explanation why resilience management is important;
- General goals, action directions, evaluation scales, reporting templates;
- Information and knowledge sharing among municipal administrations, research institutions;
- civil protection services at local and national level as well as concerned citizen associations;
- A manual, a checklist or some informal standard for how initiatives should be prioritised organised and launched; and
- Good practices.

What are the reasons for not using formal standards?

- Every municipality is doing their own thing;
- Sometimes local/national guidance are preferred;
- Knowledge sharing issues and siloed skills as well as resources;
- Growing criticism that all of the additional administrative burden is placed on employees; and
- Often experienced as a control function and a lack of confidence that employees solve the task in a professional manner.

Which Format should a resilience related standard have?

- Toolbox for each city to 'pick and choose' the most appropriate issues for them;
- Helpful if the standard was provided as a framework of steps or stages; and
- Quantifiable values can be described (e.g. indicators on climate change).

Finally, the 'supply side' and 'demand side' have been brought together to identify the standardisation potential. The SMR Project evaluated four out of the six tools to have a significant potential for standardisation - the Resilience Maturity Model (RMM), the Risk Systemicity Questionnaire (RSQ), Resilience Information and Communication Portal (RP), and the European Resilience Management Guideline (ERMG).

CEN Workshop Agreement

The identified standardisation needs can be met through the development of a European Committee for Standardisation (CEN) Workshop Agreement. A CEN Workshop Agreement (CWA) is described in the CEN (European Committee for Standardisation) - CENELEC (European Committees for Electrotechnical Standardisation) Guide 29. The guide details the characteristics and the development process of a CEN Workshop Agreement. A CEN Workshop is basically a working platform open to the participation of any interested party. The proposal of a new CWA leads to the creation of a new Workshop. Next, the proposer of a CWA shall prepare a draft Project plan, a self-assessment and undertake an analysis of the degree of interest in the subject across different European countries and amongst different stakeholders.

The Project Plan of a CEN Workshop Agreement contains the CEN Workshop background, a description of the scope, the objectives, the time schedule of development and the contact persons. After one month of publication of the Project Plan on the CEN website, a Kick-off Meeting needs to be organized. During the Kick-off Meeting of the CEN Workshop, the Project Plan is confirmed and the chairperson as well as the secretariat elected.

In the development phase of the CWA, the participants need to agree on the content of the document. Public consultation is mandatory, if the CWA deals with a safety aspect (the draft CWA will be posted on the CEN website for a minimum of 60 days). For any other CEN Workshop, it is recommended, but not mandatory.

A CWA is valid for 3 years, after which the participants of the CEN Workshop are asked to make a choice to reconfirm, revise, upgrade into a standard/ technical specification or withdraw the CWA.

Strategy for Standardisation

The initiation of the standardisation activities depends mainly on the outcome of the standardisation research and the identification of standardisation potentials. The SMR tools that have been considered as most practical to transfer into a standard were the RMM, the RP and ERMG.

The standards series initiated through the SMR Project has the general title of 'City Resilience Development' – as all Project activities are referring to resilience building activities of cities – and as a subtitle of each CWA of the corresponding tool.

In summary the following three standardisation activities have been initiated:

- City Resilience Development – Operational Guidance;
- City Resilience Development – Maturity Model; and
- City Resilience Development – Information Portal.

As DIN, the German Institute for Standardization, is the only national standardisation body within the funded Projects under the same call (DRS-7 – DARWIN, RESOLUTE, RESILENS, IMPROVER), it was agreed with the funding authority that SMR will serve as a focal point for the other DRS-7 Projects. This was already approved and initially fostered by the SMR consortia within the European Workshop on Resilience in Cities and Communities that took place on 4th April 2017 at DIN in Berlin. All Projects

and cities that attended were actively invited to join the development process of the standardisation activities of the SMR Project.

When the three CWA's are finalised, it is proposed to actively advertise these standards within the relevant standardisation committees and to consider the possibility to adopt it on different national levels (e.g. in Germany as DIN SPEC (CWA)). In particular, the promotion of the CWAs within the following technical committees is envisaged:

- CEN-CENELEC-ETSI Sector Forum on Smart and Sustainable Cities and Communities;
- CEN/TC 391/WG3 Crisis Management/Civil Protection;
- ISO/TC 268 Sustainable Cities and Communities (mainly the International Organisation for Standardisation Technical Committee (ISO/TC) 268/SC 1 Smart community infrastructures); and
- ISO/TC 292 Security and Resilience.

From the beginning of the development of the CWAs, these technical committees were kept informed about the development process. Furthermore, SMR became a liaison organisation type D of the ISO/TC 268.

DARWIN also contributed to the standardisation activities of ISO/TC 292 Security and Resilience and CEN/TC 391 Societal and Citizen Security. The Project supported the development of 'ISO 22300 Security and Resilience – Vocabulary' and 'FprCEN/TS 17091 Crisis Management – Guidance for developing a strategic capability'. DARWIN has attended standardisation activities providing expert comments on standard formulation. These comments used knowledge gained through the Projects e.g. DARWIN literature survey.

City Resilience Development – Operational Guidance

The CEN Workshop was initiated in September 2017 through the preparation of the corresponding Project plan. The chairperson of this CEN Workshop is Vasileios Latinos from ICLEI (Local Governments for Sustainability, European Secretariat). The draft Project plan for this CEN Workshop was published on the CEN website for approx. two months and the kick-off took place on 8th November 2017 in Thessaloniki. The development team consists of 22 organisations from 12 different countries.

The envisaged CWA defines an operational framework for cities that provides guidance on local resilience planning and supports their efforts in building resilience.

The standard is primarily targeted towards policy and decision makers at city level and councillors working for climate adaptation and urban resilience, as well as to other city stakeholders working on resilience in their cities, (e.g. - examples but not limited to - CI managers, service providers, emergency services, individuals, media, non-governmental organisations, academic and research institutions, consultancies).

City Resilience Development – Maturity Model

The CEN Workshop was initiated in September 2017 by the preparation of the corresponding Project plan. The chairperson of this CEN Workshop is the Project coordinator of SMR - Jose Maria Sarriegi

from TECNUN (University of Navarra). The draft Project plan was published on the CEN website for approx. two months and the kick-off was taking place on 8th November 2017 in Thessaloniki. The development team consists of 23 organisations from 11 different countries.

The scope of the CEN Workshop is to develop a CWA that defines a framework to show the ideal path in the resilience building process of a city. This framework will be based on maturity stages a city should go through.

The standard is primarily targeted towards policy and decision makers at city level and councillors working for resilience in their city, as well as any other city stakeholders working on resilience (e.g. - examples but not limited to – CI providers, service providers, emergency services, citizens, individuals, media, non-governmental organisations, academic and research institutions, consultancies).

City Resilience Development – Information Portal

The CEN Workshop was initiated in May 2017 by the preparation of the corresponding Project plan. The chairperson of this CEN Workshop is Tim A. Majchrzak from Centre for Integrated Emergency Management (CIEM) (University of Agder). CIEM has been responsible for the development of the Resilience Information and Communication Portal (RP). The draft Project plan was published on the CEN website for one month and the kick-off took place on the 21st of June 2017 in Brussels. In total 9 organisations from 5 different countries are participating in the development of the corresponding CWA. Particular the research Project RESOLUTE is a big contributor of this CWA.

The CWA provides a list of requirements for how municipalities can equip an information system that facilitates resilience building through collaboration, communication, and engagement. This marks the functional specification of an RP. The portal is a platform for communication within a local government, between a local government and its overall stakeholders, and between a local government and citizens. Requirements aim towards a broad-purpose, easy-to-use platform that provides versatility and flexibility.

This document is intended to be used by information technology professionals and information technology decision-makers. It provides them with support in planning municipal information technology as well as operative help for the development process. The functional specification does not impose any specific paradigms, technological frameworks or third-party programs. The specification takes into account existing information technology infrastructure and following the recommendations can complement it. The specification provides for significant freedom and room for customisation. This facilitates a technological solution that aligns with political decisions, particularly deriving from a local government's information technology strategy.

Status and Further Needs

Resilience has raised a substantial interest across many industry sectors. This interest has been motivated by a wide variety of perceived needs and challenges. The changing nature of risk, related to an increased operational complexity and uncertainty, can be found at the core of most investments in resilience. However, resilience perspectives remain quite diverse, which inevitably results in the pursuit of equally diverse solutions and approaches. Definitions and understanding of resilience concepts remain very diverse and the five DRS-7 Projects here discussed offer considerably different

approaches to the implementation and management of resilience. Although some variances emerge from the different Project conceptual frameworks, they can essentially be considered the consequence of different sector needs and scopes of intervention.

The far-reaching nature of resilience as a concept leads to the possibility of valid contributions from many different approaches. While these can be complementary, the challenges for integration are as important as the different objectives and scope adopted by each of the Projects, and other industry needs potentially not addressed by these Projects.

A coherent and organised body of knowledge and methods cannot exist without conceptual clarity, in the same way that conceptual robustness is demonstrated by the coherency and consistency of the applied knowledge and methods that are derived from it. Thus, progress on resilience understanding and application should be addressed from two perspectives:

- The clarification of factors and aspects that are conceptually coherent within the scope of a resilience definition, and of the resulting tools and methods. This involves the identification of clearer boundaries between what it is and is not consistent with resilience as an organisational characteristic that must be managed;
- The development of an organised structure of knowledge and methods on resilience that supports the application of conceptual elements and tools according to a suitable methodological approach and within relevant contextual settings. As no single approach to resilience can be considered valid across the wide diversity of domains and organisational needs, a comprehensive mapping of resilience knowledge and methods to relevant domains and scope of application is needed.

Significant progress has been achieved in terms of the conceptual clarification. Section 2 of this paper offers a comprehensive overview of the perspectives on resilience across the five Projects. Keeping in mind that each of these perspectives were distilled from extensive literature reviews and research work, it can be argued that DRS-7 achievements are considerably robust in this domain.

The development of validated models of resilience are needed to support further progress on applied tools. Models are particularly relevant for the demonstration of indicators and assessment tools. A model provides traceability and meaningfulness for tools in view of different contexts of application, which becomes a fundamental support to decision-making in the scope of resilience management. The broadness of resilience concepts and practices are likely to render the integration of all relevant aspects within a single model an unrealistic endeavour, as the obtained model may become too complex to support resilience management needs. DRS-7 Projects provide considerable progress towards this endeavour, namely through the different sets of guidelines developed. However, integration and further validation work is needed before work on comprehensive modelling can be carried out.

Further work is needed to systematically relate concepts and methods to their relevant scope and domain of application. Practical applications of resilience have been demonstrated and the corresponding approaches have been validated, showing an improved level of maturity of the proposed solutions. Still, further work is needed towards their implementation. The rolling out of interventions, methods, tools and indicators across different domains and scenarios are needed to test the validity and the applicability of their output to the management of resilience. This will also give way enhancing the understanding of resilience and identification of aspects of resilience that are not yet addressed by the approaches offered by these five Projects and which domains or industry sector specificities require additional effort in terms of the development of dedicated tools and

methods. The roadmap towards integration here proposed addresses the priorities and requirements previously mentioned.

6. ROADMAP TO INTEGRATION

The roadmap proposed aims to produce a path for the integration of DRS-7 Project and achievements, and for future research and development on resilience. Three specific objectives should be considered for the development of the work plan laid out by this road map:

- The integration of all DRS-7 Projects, namely guidelines, resilience assessment and monitoring tools, and resilience management interventions and approaches, by mapping onto a resilience model and disaster management life cycle the relations between these outputs.
- The identification of resilience conceptual and applied aspects that may require further work, namely through the identification of gaps between the different Project contributions and the outcome of the taxonomy and conceptual framework to be developed, where such Project contributions may overlap, and potential additional clarification and refining may be needed.
- The outline of requirements for future work for the development of resilience management.

A possible path could be approach grounded on the development of a taxonomy, which will produce a systematic description of the relations between the different contributions and output from the DRS-7 Projects. A conceptual framework will support the definition of the descriptors for the taxonomy. classification criteria. The taxonomy work will then support modelling activities, based on which Project tools and methods can be mapped in view of their scope and context of application, and from which future work on resilience enhancement can be identified.

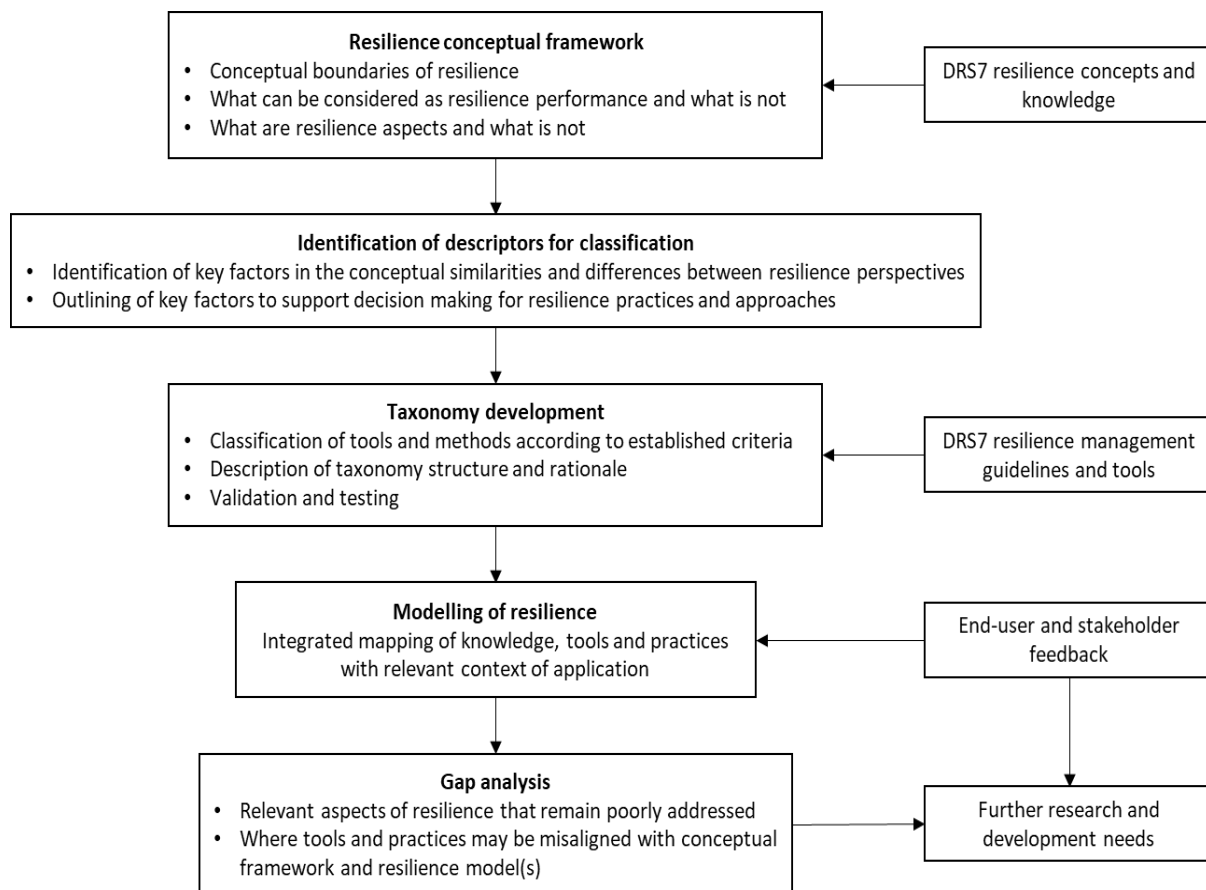


Figure 7.1 Resilience Roadmap Approach

The contributions and achievements of DRS-7 Projects respond to different steps described in the roadmap. The following aspects are particularly relevant as contributions to the roadmap:

- The different sets of **guidelines produced and work on standardisation**, not only contribute to the conceptual framework through the research and literature review work from which they were developed, but also provide an extensive support for the definition of the taxonomy descriptors. They are also one of the key inputs from the Projects to be mapped onto a resilience model.
- **Assessment, metrics and monitoring tools and the various validation and testing approaches** that were undertaken by each of the Projects, in particular involving end-users and other relevant stakeholders, will feed the core of the taxonomy work and support its validation.
- The **contacts and networks** developed throughout the duration of the Projects will provide the means to generate end-user and stakeholder feedback.

The roadmap outlined offers ample opportunity for the enhancement of Project achievements and for the further exploitation of their output. It also highlights the consistent and integrated continuity of work in terms of resilience related research and development within the scope of improved societal security.

7. CONCLUSION

This White Paper delineates the productive activity of the five DRS-7 Projects. It answers the invitation “to link the on-going efforts and share EU-wide risk assessment and mapping *approaches*” outlined in the original DRS-7 call topic.²⁶ The research activity of the five Projects has resulted in a community of resilience scholars actively participating in and monitoring the EU effort to create and sustain smarter responses to adverse man-made and environmental events. There is a consensus in all Projects that greater focus in disaster resilience is related to bouncing back. The Projects have broadened this perspective with complementary perspectives and concepts. CIs, cities and society are not only expected to respond and recover but to look for ways to thrive in the new ecology of adversity. To facilitate this goal, the DRS-7 Projects have provided extensive literature reviews, guidelines, interventions and toolkits to garner end user input and to provide practical resources for policy advisors, CI users, and owners. The interdependency²⁷ of critical resources leads to a cascading effect during and subsequent to an adverse event. This infrastructural reality is a common theoretical thread among the DRS-7 consortia and in practice, all five Projects produce cascading effects on each other, from enriching the scholarly baseline to symbiotically developing each other’s standardisation and integration strategies.

The consortia aim to improve policy and implementation strategies across the EU and beyond. The DRS-7 consortia recommend a paradigm shift from protection to resilience and that this be reflected more in the EU/Member States policy documents. This leads to the conclusion that EU CIs need to be regulated across state, semi-state, and private providers. The question of Regulation or public-private partnership has risen to the top of all five project conclusions and the consortium call for further investigation into how best to protect EU CI and plan for liability and compensation strategies in the event of loss and/or damage to said CIs. The roadmap for integration demonstrates a robust strategy for exploitation of the combined expertise of the DRS-7 consortia and provides a tangible resource for securing a more resilient future for Europe.

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