RAIN PROJECT

Decision support tools or infrastructure owners and operators

Improving resilience in the face of extreme weather events

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Why was it done

- The developed ORT-application stems from the need expressed by infrastructures' owners and operators to be more involved in the definition of criteria and evaluation methodologies;

- It also implies the possibility to include the evaluation of elements traditionally isolated to qualitative research, and thus not computable in a quantitative vulnerability assessment;

- It allows the creation of an integrated framework for evaluating critical infrastructure's resilience to the impact of natural hazards.

What is developed

An application to assess:

- The level of vulnerability to extreme weather events;
- The level of resilience to these events;
- The possibility to compare outcomes with others;
- And analyse where to improve the preparation.

As a proof of concept for the practical use by end-users:

- Infrastructure owners and operators;
- Municipalities.

Why it is useful

- It allows for the identification of strengths and weaknesses in the system at stake, allowing for an informed decision-making;

- It isolates elements of resilience and allows to identify, among these, the ones that are more easily improvable for positively impacting on the overall resilience (regardless of the underlying vulnerability);

- It supports effective decision-making on the mitigation of negative impact of extreme weather.

Theory behind the criteria

- Selection of dimensions and variables for the evaluation of vulnerability and resilience stems from the work conducted by ISIG within the ECOSTRESS project (www.ecostress.eu);

- They were selected after a rigorous and thorough literature review on the main scientific articles related to resilience and vulnerability evaluation following the IPCC approach (detail on the specific literature is available in the report);

- Results of partner UNIZA related to the vulnerability index included.

Theory behind the criteria

For the development of RAIN ORT, the variables have been further selected and rephrased so to better meet ORT specificities.

Variables were selected for two macro-dimensions:

a) **Sensitivity** that in RAIN ORT was conveyed under the umbrella of 'Vulnerability assessment', as context data, less likely to be changed in short periods of time;

b) **Adaptive capacity** 'Resilience' in RAIN ORT; by understanding resilience as the capacity of a community to cope with and recover from a natural hazard.

Theory behind the criteria

For each macro-dimension, four dimensions were analysed:

1. **Social**

- Demographic composition of population defining vulnerability
- Existence of social networks and skills to evaluate resilience

2. **Economic**

- Resources distribution within the community to evaluate vulnerability
- Potential to mobilise resources when needed as criteria for resilience

3. **Infrastructural**

- Density of buildings as element of potential vulnerability
- Capacity to upgrade infrastructures to be better prepared, as criteria for resilience

4. **Institutional**

- Existence of networks among institutions for mitigation/risk management to identify vulnerability
- Capacity of local authorities to coordinate and work in team as measure of resilience

Objective Ranking Tool (ORT)

ORT is:

- An online web-based software tools;
- Highly secured;
- Specific applications developed;
- Easy to adapt, easy to use;
- Give quick results.

Objective Ranking Tool (ORT)

Theory behind the tool:

- Use of Delphi-panels (expert judgment);
- Use of AHP: Analytic Hierarchy Processing;
- Based on the principles of Similarity Judgment.

ORT can be used in:

- Any form of comparison;
- Decision making;
- Ranking processes.

Criteria

Most important ones based on AHP
• Existence of public evacuation mechanisms (5.7%) • Knowledge of citizens about temporary measures (5.1%) • Availability of risk assessments included natural hazards and extreme weather (4.9%) • Preparedness protocols implemented (4.0%) • Early warning system in place for people and businesses (3.9%) • Education, training and exercises in place (3.8%) • Implementation of ad hoc mitigation activities (3.6%) • identification of (infrastructural) assets needing upgrading as means of mitigation and prevention (2.8%) • Distribution of food and goods (2.7%) • Level of awareness of the degree of dependence of the local economy on natural hazards or extreme weather events (2.6%) and availability of first responders (2.6%)

ORT Test

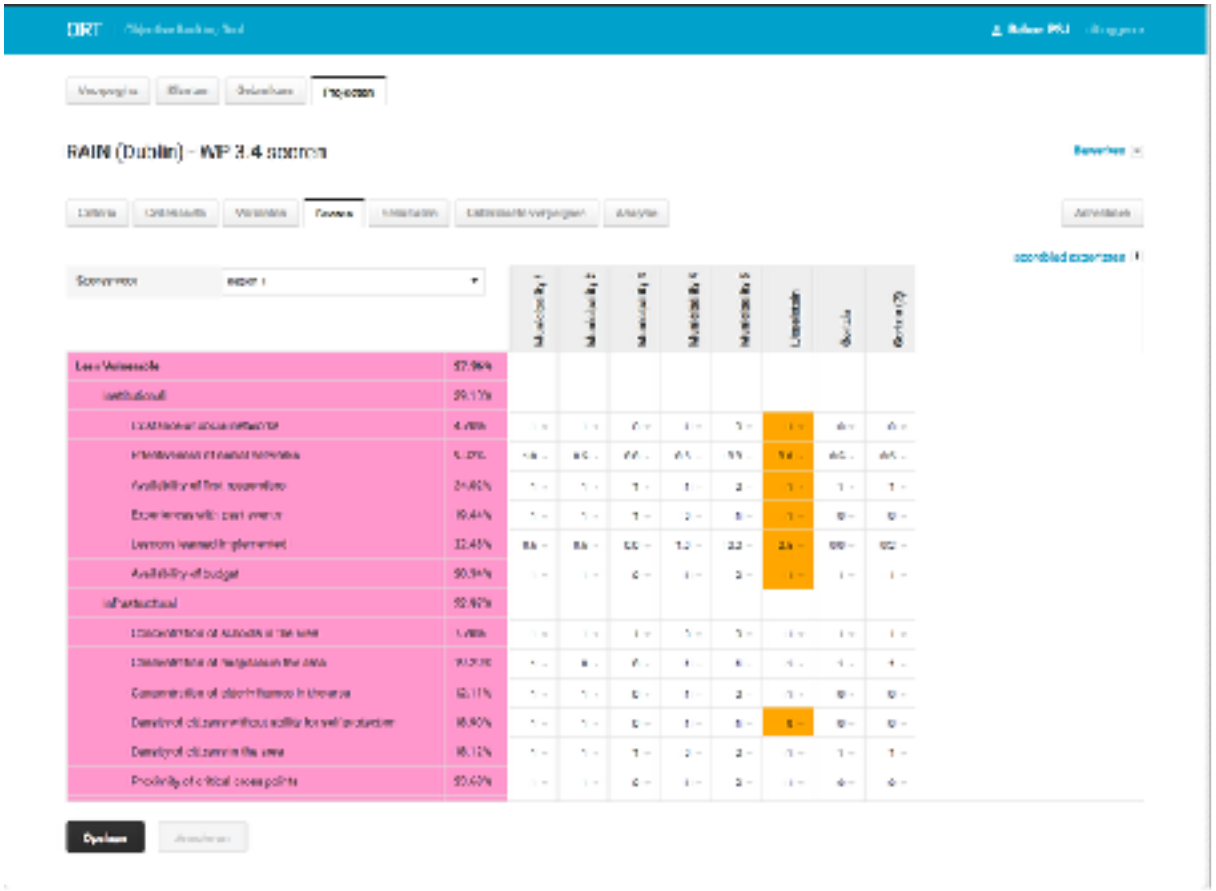
ORT was tested:

- Through in-depth interviews with local authorities and operators in The Netherlands and in Italy;
- Through dedicated sessions with the above mentioned stakeholders to fill in the self-assessment grid.

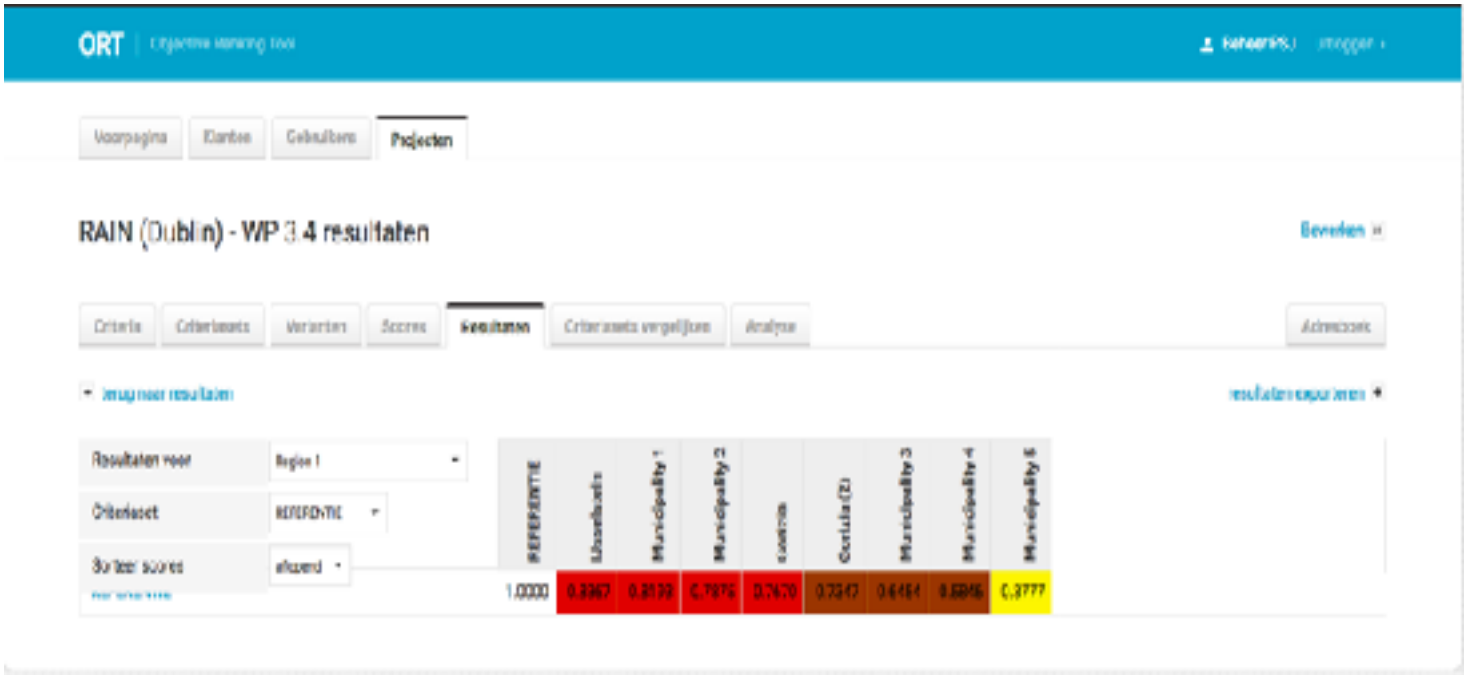
The insights gathered:

- Were used to modify criteria so to make them more intuitive;
- Were used to modify the range of values for specific items, where more detail was deemed relevant by stakeholder for an appropriate evaluation;
- Highlight the need for specific contextualisation of the tool in different study areas (i.e. the 'one size fits all' solution leaves sometimes out the specificities of the area that most contribute to resilience for that system).

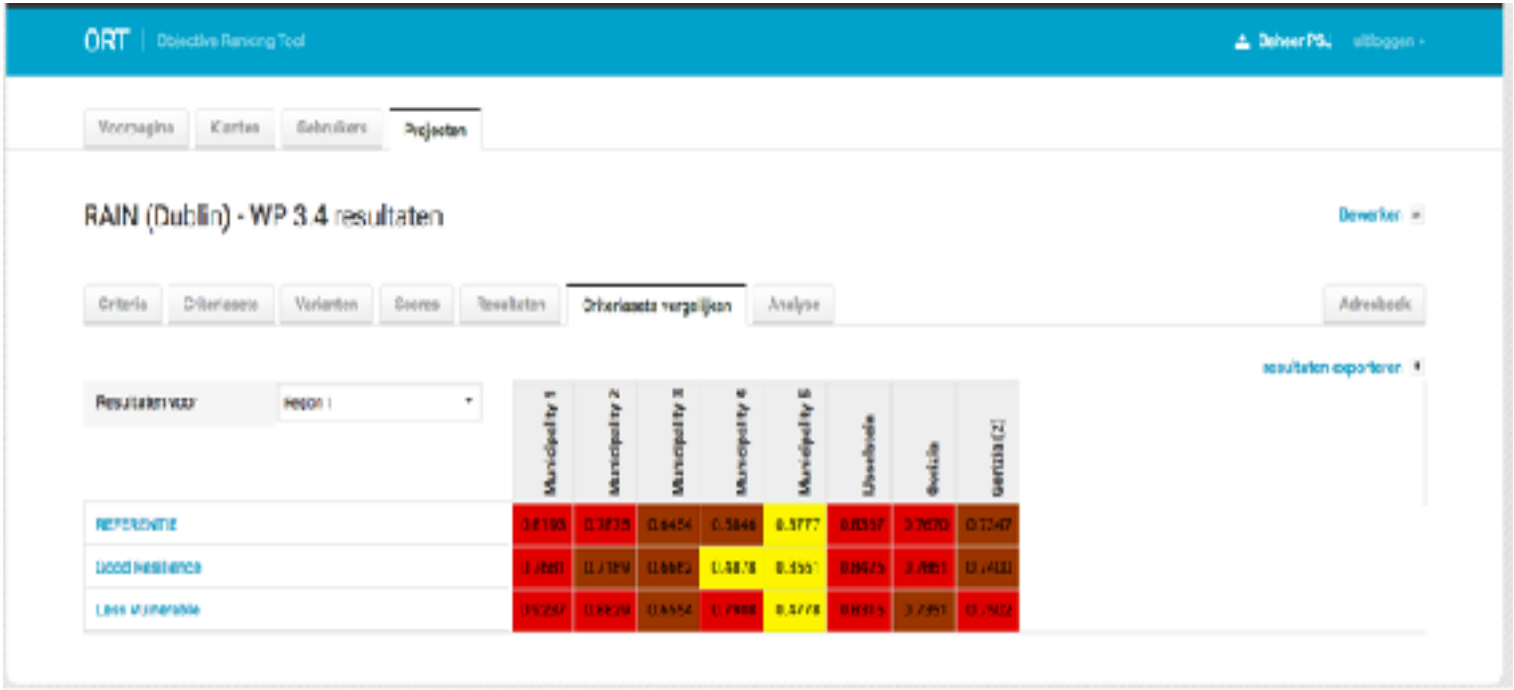
Proof of concept for municipalities



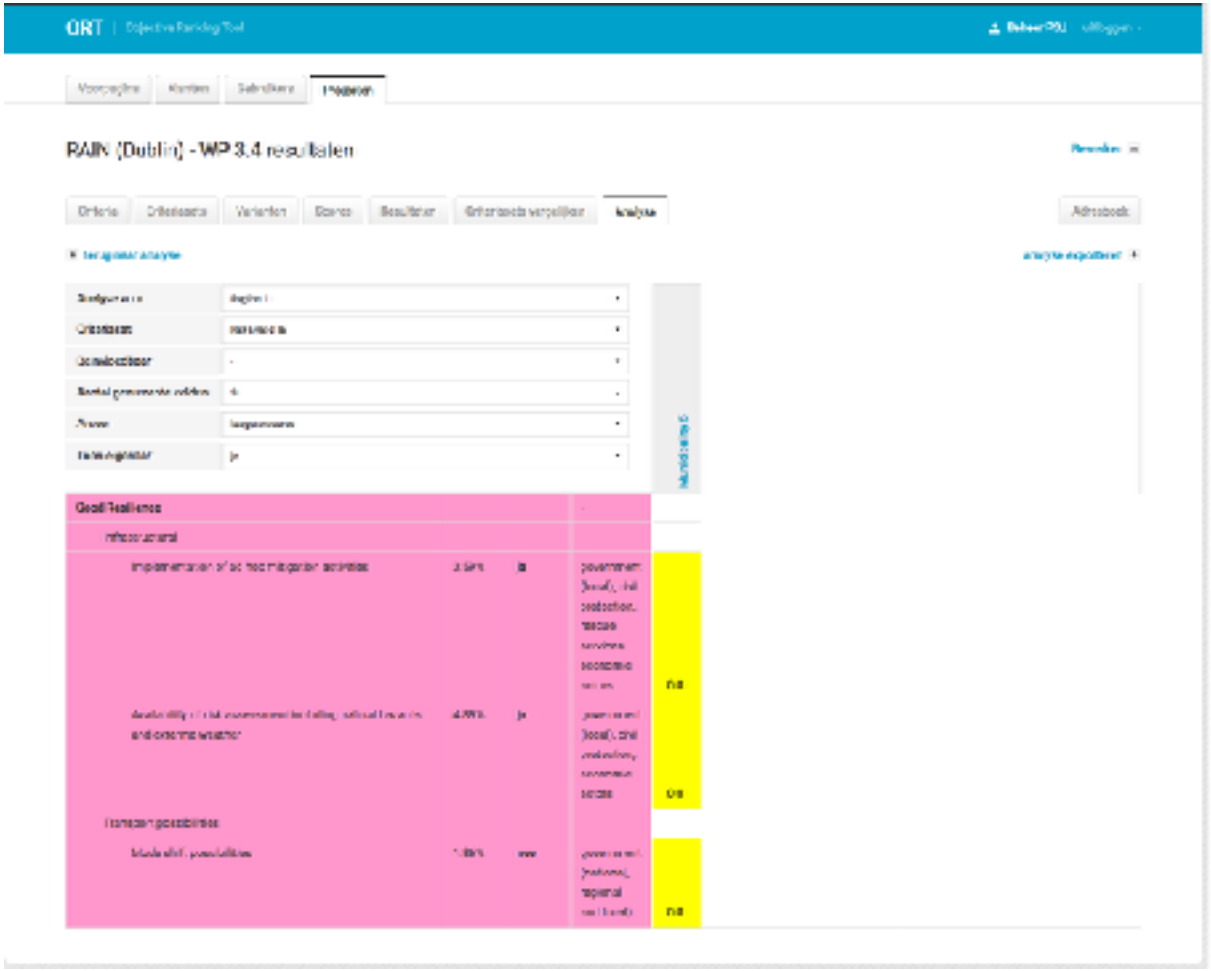
Proof of concept: outcome



Proof of concept: criteria sets



Proof of concept: analyses



Conclusions

- Resilience can be enhanced by stakeholders in a relative short time-frame;
- Vulnerability can’t be changed that soon, as it based often on demographic factors, resources distribution etc.;
- A community can be and remain inherently vulnerable, while developing effective resilience-enhancement strategies;
- Possibility to compare the outcome of different stakeholders so decisions can be made where cost-effective interventions can be made;
- Stakeholder involvement is needed from the beginning of assessment project;
- ORT is relatively easy process which can be done as a self-assessment;
- Guideline should be developed.

For infrastructure owners and operators

- Principles behind the ORT-application are valid;
- Develop area specific weather types;
- Judge the criteria;
- Score per weather type the outcome;
- Compare differences between participants
- Based on the analyse part within the application judge improvements

Lessons identified

- Involvement of end-users is needed in scientific work to ensure practical implementation of the scientific work;
- Involvement of end users is needed in order to guarantee a user-oriented approach, based on effective need assessment, as defined by EC Innovation standards;
- Calibrating developed criteria is needed to ensure acceptance from stakeholders; criteria and relative weight should be developed for different weather types;
- Proof of concepts should be organised with in-depth involvement of end-users;
- Pilot phases should cover longer time frames within the project.

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