



EU-CIRCLE

A pan-European framework
for strengthening Critical
Infrastructure resilience to
climate change

D7.5 - Open Invitation to non-consortium members

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<i>Statement</i>	
<p>Acknowledging that significant knowledge does exist through private, national and international projects, EU-CIRCLE made an open invitation to the CI scientific community to integrate their data (climate, CI, loss due to related hazard), solutions and models, and collectively present them during a demo session in context of the project's Final Workshop. EU-CIRCLE has addressed an open invitation to non-consortium members to join the project platform providing data, models and use cases. The communication channels for sharing such invitation included the project website, partners' social networks and EU-CIRCLE presentations made in context of dissemination events.</p>	



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Executive Summary

This Deliverable presents an overview of the activities to invite the stakeholders and research community to be involved in the activity of EU-CIRCLE. The invitation includes clarification on how to participate, such as providing tools and climate data, proposing new algorithm schemes and models and validating existing results. The relative actions taken to address the interested R&D community to join the project activity included:

- An open invitation via the official webpage of EU-CIRCLE;
- Presenting the project and addressing the invitation to potential EU-CIRCLE users in a number of relevant conferences and workshops; and
- Initiating personal contacts and carrying out discussions with researchers and stakeholders outside the EU-CIRCLE consortium

The outcome of the collaboration between EU-CIRCLE partners and non-consortium stakeholders will be presented in the final workshop at the end of the project, during the demonstration of the EU-CIRCLE framework.



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1 Introduction & Methodology

EU-CIRCLE is the primary scientific and engineering step towards a solid approach for assessing infrastructure resilience to climate change and, in addition, towards an innovative prototype solution for high added value and detailed modelling of large scale interconnected CI supported by modules to assess cost-efficient adaptation of solutions in different types of scenarios. EU-CIRCLE will provide the generic plug-and-play environment for different and diverse types of simulation models and climate information to be introduced and will apply partners' capabilities (models, climate data, risk, resilience assessment, adaptation scenarios) in the suggested test cases.

The consortium proposes two high impact activities that will directly increase the added value and acceptance of EU-CIRCLE resilience framework and CIRP in the CI stakeholder's community. They will also improve the transfer of knowledge and innovation from the scientific community to industry and CI stakeholders by:

- Providing SimICI as a reference test-bed facility for infrastructures and interconnections present, that will be used for testing the validity, functionality and capacity of the project's activities in a controlled environment; and
- Allowing members outside the consortium, to validate their solutions and modelling tools, in the SimICI environment during the course of the Final Workshop.

The latter is addressed in the current deliverable.

The active engagement of CI stakeholders in EU-CIRCLE will be driven through active participation providing oversight that guides the resilience framework development towards meaningful and directly accessible and interpretable outcomes. That intention was communicated to relevant audiences through a series of dissemination actions which included:

- Announcement of the Open Call Invitation in the website of EU-CIRCLE;
- Presentation of the invitation to the scientific society in context of relevant events; and
- Personal communication to interested groups.

Furthermore, EU-CIRCLE is trying to be as open as possible, hence, SimICI and the virtual datasets is the vehicle to participate in the EU Open Research Data Pilot¹. The goal of Open Research Data Pilot is to make the research data generated by selected Horizon 2020 projects accessible with as few restrictions as possible, while at the same time protecting sensitive data from inappropriate access. EU-CIRCLE adopts those objectives and in addition to this, the datasets generated will follow the EU policy and JPI² approach guidelines. In addition, part of the data will be shared when the related deliverable or paper has been made available at an open access repository according to Open Research Data Pilot requirements.

This document is a type "OTHER" Deliverable, which summarizes the actions taken by the consortium concerning the open invitation to non-consortium members to join the EU-CIRCLE activity. It is submitted in the form of an activity report.

¹ <https://www.openaire.eu/opendatapilot>

² <http://www.jpi-climate.eu/home>



2 Website

In the current phase of the project (M25), the project site was used as a platform to address non-consortium members to contribute in the final stages of the development of the EU-CIRCLE solution, by populating the project toolbox with their tools and data.



Figure 1: Screenshot of the invitation message published in the EU-CIRCLE website

The announcement of the open invitation that posted in the website (<http://www.eu-circle.eu/about/open-invitation/>) is presented here below:

“The EU-CIRCLE project invites researchers and stakeholders in the scientific domains of critical infrastructures, climate change and resilience to participate in the project.

EU-CIRCLE has developed an innovative framework for supporting the resilience of interconnected European Infrastructure’s to climate pressures, supported by an end-to-end modelling environment where new analyses can be added anywhere along the analysis workflow and multiple scientific disciplines can work together to understand interdependencies, and jointly discuss present and past research results.

Stakeholders and researchers may become involved through any of the following means:

- *Providing tools for various phases of the analyses*
- *Providing climate data*
- *Proposing new algorithm schemes and models*
- *Validating existing results*
- *Participating in the final demonstration of the EU-CIRCLE framework*

All these will be tested in a virtual environment created by the EU-CIRCLE project, which represents interconnected infrastructures [energy, transportation, water] in realistic conditions.

For more information and ways to join, please contact :

Dr. Athanasios Sfetsos, EU-CIRCLE coordinator

Email: ts@ipta.demokritos.gr “



3 Presentation in events

Communication and dissemination have been identified as integral facets of EU-CIRCLE research activities; actions vital in raising awareness and promoting the impact and added value of the project. During the latter stages of the first project period, the project partners have been gradually begin to communicating and disseminating the project's achieved results - "results – oriented" phase. The results includes tools that are incorporated in a generic climate infrastructure resilience which is intended for CI stakeholders and operators. In order for the platform to prove being flexible and able to address the operational problems of the users, EU-CIRCLE calls non-consortium members to contribute and populate the derived toolbox. Among other methods, the announcement was made by a series of presentation in the following events:

- **Disaster Risk Management Knowledge Centre (DRMKC) - Workshop with FP7 and H2020 projects on critical infrastructure protection.** (16th -17th March 2017, Brussels, Belgium)

The workshop aimed to provide an overview of the progress made by the projects with focus on the results that may be used in practice, collect feedback from stakeholders, identify knowledge gaps and research needs for better scientific support to policy implementation.

17 March 2017	
Session 4: Relevant on-going activities	
Moderator: Laura Palomo Rios, Executive Agency for SMEs	
Interdependencies and cascading effects for resilience assessment of critical systems.	
Georgios Giannopoulos- European Commission (DG JRC)	Presentation
https://ec.europa.eu/jrc	
Risks of weather extremes to critical infrastructures in Europe under climate change.	
Luc Feyen- European Commission (DG JRC)	Presentation
https://ec.europa.eu/jrc	
Natural hazard impacts on industry and critical infrastructures.	
Georgios Karagiannis- European Commission (DG JRC)	Presentation
https://ec.europa.eu/jrc	
RESIN project: Climate resilient cities and infrastructures.	
Erich Rome- Fraunhofer Institute (DE)	Presentation
https://www.fraunhofer.de	
EU-CIRCLE project: A pan-European framework for strengthening critical infrastructure resilience to climate change.	
Athanasios Sfetsos- National Center for Scientific Research "Demokritos" (GR)	Presentation
http://www.demokritos.gr	
RESCUE project: Resilience to cope with climate change in urban areas - a multisectorial approach focusing on water.	
Marc Velasco- SUEZ Advanced Solutions (SUEZ) (ES)	Presentation
http://suez.es	
Ideas on the future of Early Warning Systems in vulnerable cities.	
Stefano Parolai- Helmholtz Centre Potsdam (GFZ) (DE)	Presentation
http://www.gfz-potsdam.de	
CIPRNet network of excellence: Critical infrastructures preparedness and resilience research network.	
Erich Rome- Fraunhofer Institute (DE)	Presentation
https://www.fraunhofer.de	

Figure 2: Program of DRMKC Workshop, Session 4 where EU-CIRCLE was presented

- **7th CoU Event of Community of Users on Secure, Safe and Resilient Societies** (2017, May 15th May 2017, Brussels)
- **52nd ESReDA Seminar on Critical Infrastructures** (2017, May 30-31st May 2017, Kaunas, Lithuania)

Speakers shared their scientific knowledge and experience issued from areas of Critical Infrastructures Preparedness and Resilience. Different sectors were covered, such as: energy, transport, communication, civil protection, maritime-ports and nuclear reactors.

- **ECCA2017 - 3rd European Climate Change Adaptation Conference**, ~~Glasgow,~~ (5th-9th June 2017, Glasgow)

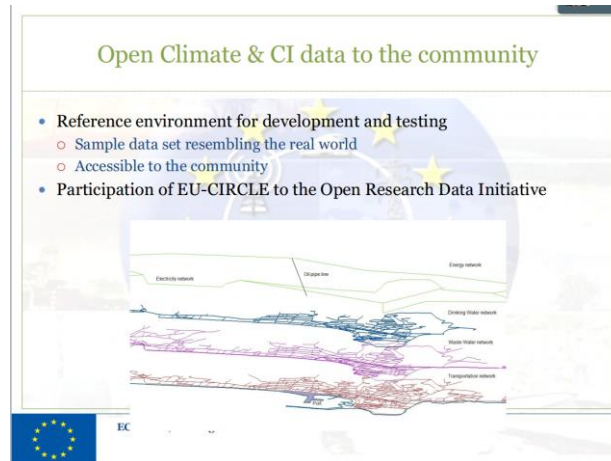


Figure 3: Slide from ECCA2017 presentation

- **SafeAthens2017** – 28th – 30th June 2017, Athens



Figure 4: SafeAthens2017 banner

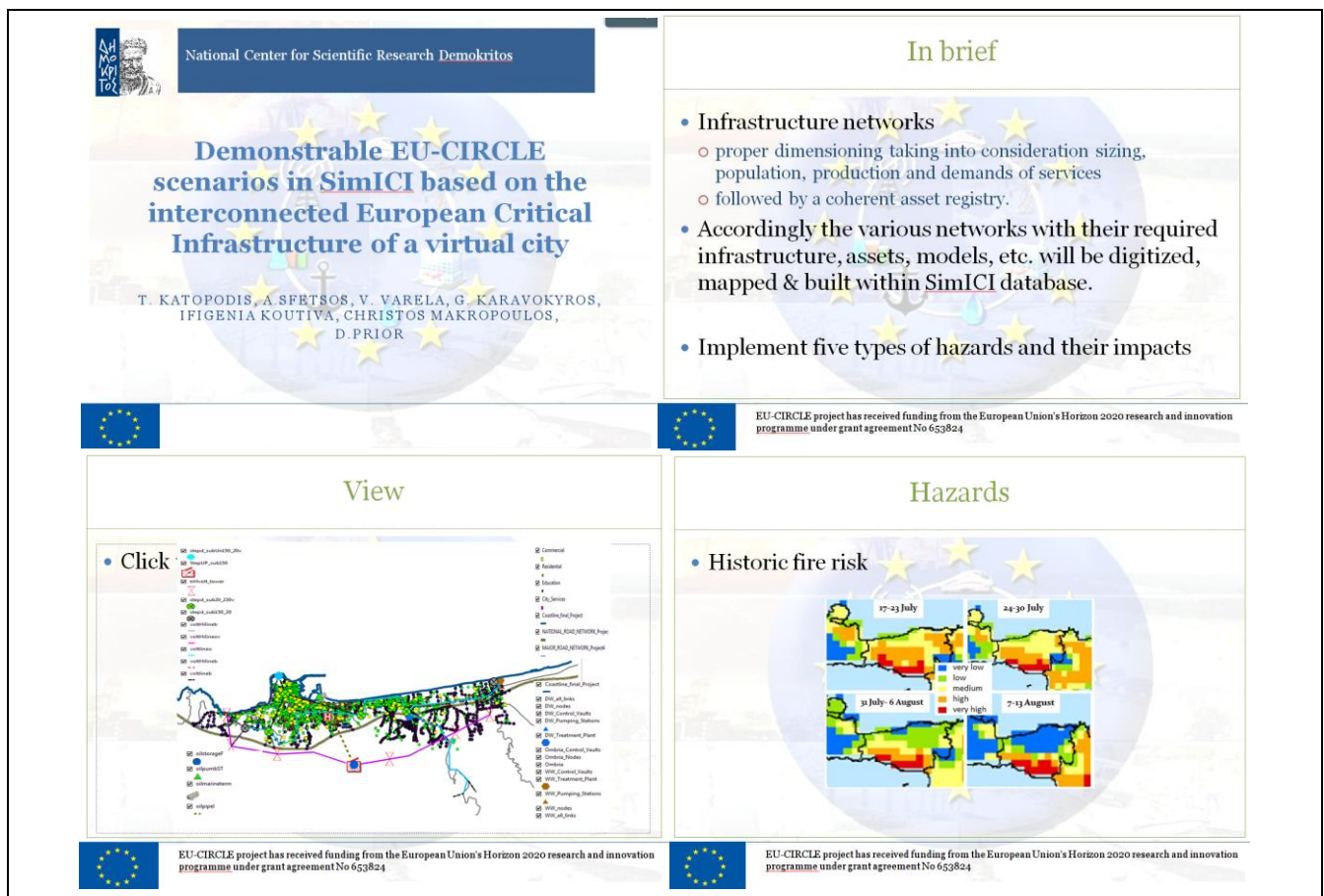


Figure 5: Slides from SafeAthens2017 presentation

4 Data and Models integration

The contribution of invited non-consortium members could be climate data and process tools, CI data in terms of structural characteristics and damage modelling, proposed risk analyses and models. The current type of files, variables and tools are based on a unified platform that serves the needs of EU-CIRCLE framework. The non-consortium members that will help to expand EU-CIRCLE framework, have to carry out their work in the same outlines.

4.2.1 Generic process

The generic process is illustrated in Figure 6. The user input consists on Climate & Hazard data (see paragraph 4.2.4) and CI data (see paragraph 4.2.3). The non-consortium members can contribute either by distributing their data or by implementing their model (see paragraph 0) and analysis (see paragraph 4.2.6).



Figure 6 Modelling process

4.2.2 Type of data

The platform components (SIMICI) allow the ingestion of different types of datasets. The file formats supported³ are:

- Shapefiles (e.g. assets)
- ASCII Grid (hazard exposure, DEM)
- CSVs (connectivity tables)
- NetCDF (climate data)
- XML (fragility/damage curves)

4.2.3 CI integration

The necessary information for inserting a CI into the EU-CIRCLE framework, is described by a five (5) part template and include the description of the assets, how they interconnect and how they are affected by a hazard⁴.

³ D5.1 - CIRP detail design document, section 8.3.3 (<http://www.eu-circle.eu/wp-content/uploads/2016/04/d5.1.pdf>)

⁴ D2.3 - Tools for processing Climate Hazards Information



Part 1. General Asset Information	
Asset Name	
Critical Infrastructure Sector	
Critical Infrastructure Sub-Sector	
Brief Description of what it does	

Part 2. Hazard Information	
Please select all hazards that can impact the asset.	
Heat waves, cold snaps	<input type="checkbox"/>
Extreme winds	<input type="checkbox"/>
Floods / costal floods	<input type="checkbox"/>
Forest Fires	<input type="checkbox"/>
Droughts	<input type="checkbox"/>
Sea level rise	<input type="checkbox"/>
Ice, frost, permafrost	<input type="checkbox"/>
Storm surges, waves	<input type="checkbox"/>
Lightning / thunderstorm	<input type="checkbox"/>
Earth movement caused by climate drivers such as rain (landslide, erosion, avalanches, rock fall, soil subsidence, liquefaction, etc.)	<input type="checkbox"/>
Please provide a description of the impacts of each hazard (as selected in the table above) on the asset. Where information such as damage functions, fragility curves etc. exist please include in the description of impacts. If this information does not exist, please make a note of this.	
Hazard	Impacts on Asset
Floods / Coastal floods	
Forest Fires	
Drought	
Sea level rise	

Please select all sub-sectors that the asset is connected and dependent on for its operation. Refer to the registry of assets to help you understand what each sub-sector does and therefore								
ASSET:								
Sub-sector	Dependency				Interdependency			
	Physical	Cyber	Geographical	Logical	Physical	Cyber	Geographical	Logical
Oil	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



Gas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Coal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Electricity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Renewables	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
District Heating	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Road	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Rail	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Aviation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Maritime	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Inland waterway	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Telecommunication	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Information Systems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Drinking Water	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wastewater	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Flood water	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chemical	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fire& Rescue Services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Emergency Medical Services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Military	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Law Enforcement	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Public Services	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Healthcare & public health	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

For each subsector that you have identified a dependency or interdependency in the table above, please state the asset within the subsector that the asset for which you are completing this report for is dependent or interdependent. Only state the assets for which you know. Please refer to the registry of assets.

Dependent/interdependent sub-sector	Asset within dependent/interdependent sub-sector

Part 4. Photo of Asset

Part 5. References for damage functions, fragility curves, (inter) dependencies



4.2.4 Climate & Hazards data

The climate and hazard parameters are the driving force behind the EU-CIRCLE analysis. The climate change related effects are divided into two different categories (a) Climate drivers (direct output of simulation models) and (b) Climate hazards, which are direct consequence of climate drivers (post-processing algorithms of the climate drivers).

Table 1. EU-CIRCLE climate parameters and their interconnections

Climate drivers	Climate hazards
Temperature	Heat waves, cold snaps
Precipitation (rain / snowfall) - humidity	Floods
Winds	Forest Fires
Cloud / fog	Droughts
Solar radiation	Earth movement caused by climate drivers such as rain (landslide, erosion, avalanches)
Sea level rise	
Ice , frost	
Strom surges, waves	

Within EU-CIRCLE the following will not be taken into account:

- Air pollution (air pollution and emission of greenhouse gases has been considered only as an environmental impact of CI⁵)
- Emissions from volcanic ashes and dust from the Saharan desert
- Epidemics and impacts from population growth of insects and endogenous species & invasion of non-indigenous species etc. whose impacts are magnified due to climate change.

4.2.5 Model integration

In case of models, the EU-CIRCLE platform incorporates the extension point concept. that provides the desired modularity and extensibility. Through this concept, components are independent of each other and their exchanged functionalities are executed through the provided extension points. As a result, the framework is open by design and easily extended to new components, such as the proposed models of non-consortium members. Such extensions would include new analysis components which implement new analysis algorithms. The connection between new analysis components and the framework will be enabled through a specific extension point, the *AnalysisExtensionPoint*⁶.

⁵ D1.3 - Report on EU-CIRCLE Strategic Context (<http://www.eu-circle.eu/wp-content/uploads/2016/04/d1.3.pdf>)

⁶ D5.1 - CIRP detail design document, section 8.3.3 (<http://www.eu-circle.eu/wp-content/uploads/2016/04/d5.1.pdf>)



interaction Extension Point Sequence Diagram [Extension Point Sequence Diagram]

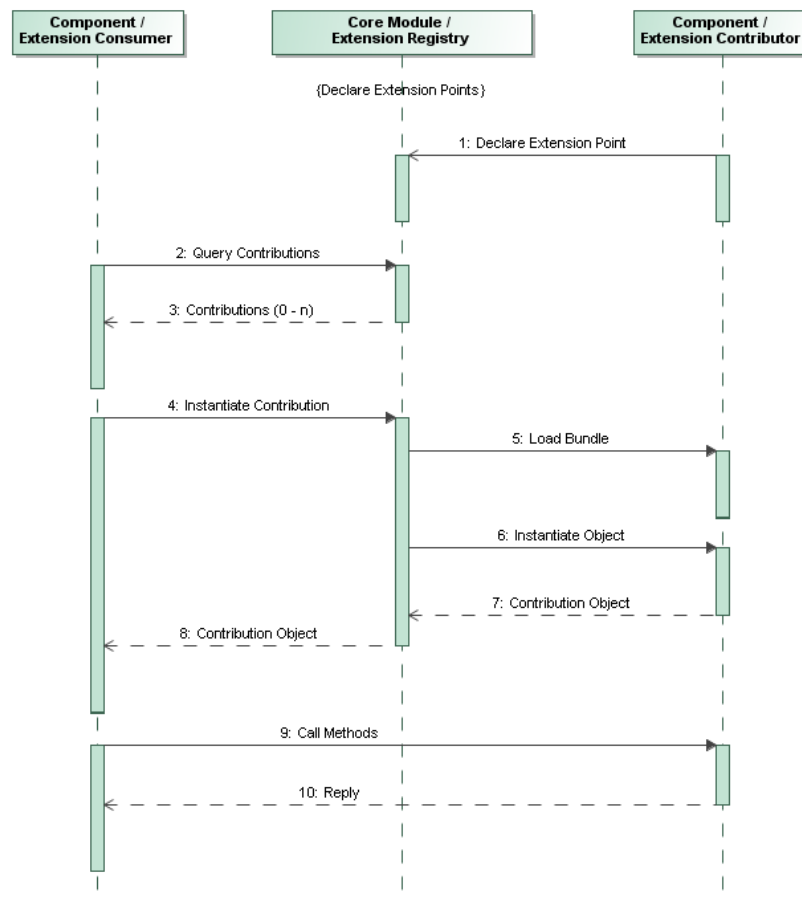


Figure 7: Extension point sequence diagram

4.2.6 Analysis integration

The EU-CIRCLE framework⁷ incorporates analysis of CIs resilience to climate-driven threats. The available indicators and analysis is based on the input data mentioned above and the network analysis, and can be expanded with the contribution of non-consortium members.

⁷ D5.1 - CIRP detail design document, section 8.3.3 (<http://www.eu-circle.eu/wp-content/uploads/2016/04/d5.1.pdf>)



5 Conclusions

This document describes the actions taken in order to invite non-consortium members to be involved in the final stages of the project. So far, the acceptance of the invitation, resulted to a number of non-consortium members that aim to be involved and interact with EU-CIRCLE partners (see **Table 2**). The consortium will pursue furthermore the collaboration and interaction with more CI stakeholders and researchers in order to populate even further the derived toolbox and deliver a highly functional and user accepted product. Dissemination activities such as social media, presentation in conferences and workshops, and personal discussion with CI stakeholders and members of the research communities, will help the formation of new cooperation. The results will be presented in context of the final demonstration of the EU-CIRCLE framework, which will be demonstrated by the consortium and where invited non-consortium members will participate.

Table 2. Overview of exchange of data and tools with non-consortium members up to August 2017

Organisation	Collaboration
RTE	During Case Study 1, RTE will provide electricity transmission data
ENEDIS	Collaboration with EU-CIRCLE project providing data and damage functions for Case Study 1
ESCOTA	Collaboration with EU-CIRCLE project providing data for Case Study 1 transportation network
NIST-CORE project	Exchange of knowledge and experience in platform development
NTUA/CIVIL ENGINEER	Exchange on water network and transportation network data and damage functions
JRC	Collaboration with GRRASP