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MISSION CE CLIMATE

ezavod

MISSION CE CLIMATE Risk and Vulnerability Assessment (RVA) methodology

Contents

1 Introduction

While countries of the EU are for some time planning and advancing green agendas for their future societal development, the detrimental anthropogenic impact on the environment and specifically climate already carries tangible consequences. Our climate is already notably changing, with approximately 1.1 °C of global average warming compared to the preindustrial era. Climate change already affects many worldwide weather and climate extremes in every region and manifests in widespread adverse impacts and related losses and damages to nature and people[1].

Climate action to limit global warming to 1.5 °C is proving challenging and off track from the progress required to meet our 2030 climate targets and protect our well-being and prosperity.[2] Global GHG emissions are higher today than in 2015, when most countries adopted the Paris Agreement.

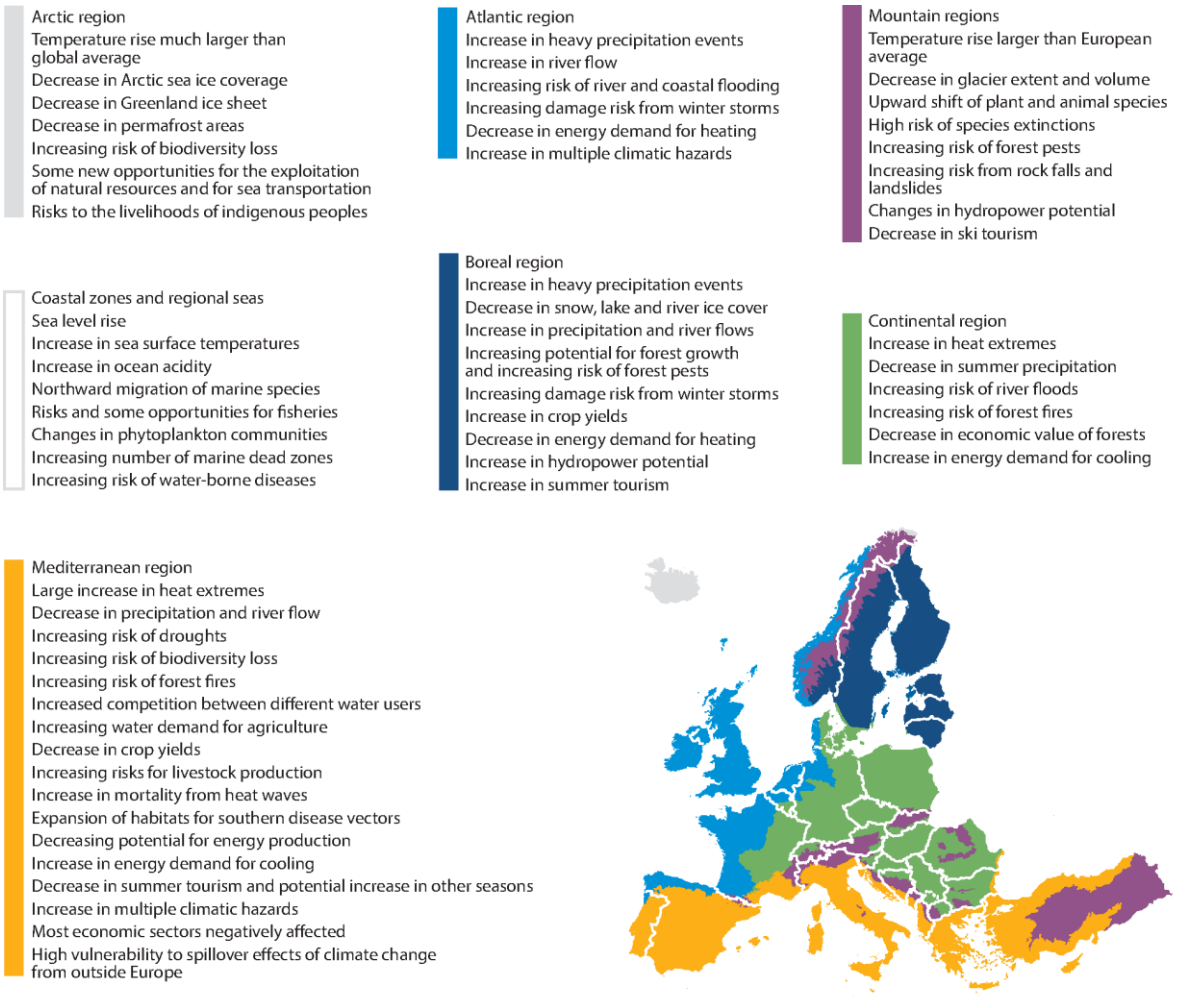
Even when fully implemented, current national climate commitments are estimated to lead to roughly 2.4 °C to 2.8 °C global temperature increase by the end of the century. At the same time, approximately 3.3 to 3.6 billion people live in highly vulnerable contexts to climate change. In such a scenario, climate hazards, exposure to them and vulnerabilities of our communities and systems can correspond to massive risks and adverse impacts on people, economies, and the environment (damages, harms, economic and non-economic losses).[3]

Hence, societies and economies in all regions need to prepare for and adapt to the arising impacts of climate change. Adaptation interventions aim to reduce risks and vulnerability at different levels (sectoral, national, or local), primarily via adjusting or transforming existing systems.

The map below, developed by EEA, portrays some of the core climate change impacts that have either already been observed or are projected to happen across different regions of Europe.

[1] IPCC AR6, 2023
[2] State of Climate Action 2022, Systems Change Lab, 2022
[3] State of Climate Action 2022, Systems Change Lab, 2022

Map: Key observed and projected climate change and impacts for the central biogeographical regions in Europe



Source: EEA, 2017

The latest IPCC report (AR6) reveals that globally, observed adaptation responses are fragmented, incremental, sector-specific, and unequally distributed across global regions, with increasing occurrences of maladaptation. The report outlines examples of effective adaptation options, including ecosystem-based adaptation approaches such as urban greening and restoration of wetlands and upstream forest ecosystems, which have been effective in reducing flood risks and urban heat; combinations of non-structural measures like early warning systems and structural measures like levees which have reduced loss of lives in case of inland flooding. Adaptation options such as disaster risk management, early warning systems, climate services and social safety nets have broad applicability across multiple sectors.

This underdeveloped climate adaptation context supports further action in risk and vulnerability assessment as a basis for informed, effective, strategic adaptation planning and impactful action for improving the climate resilience of our communities.

2 Scope and Methodology

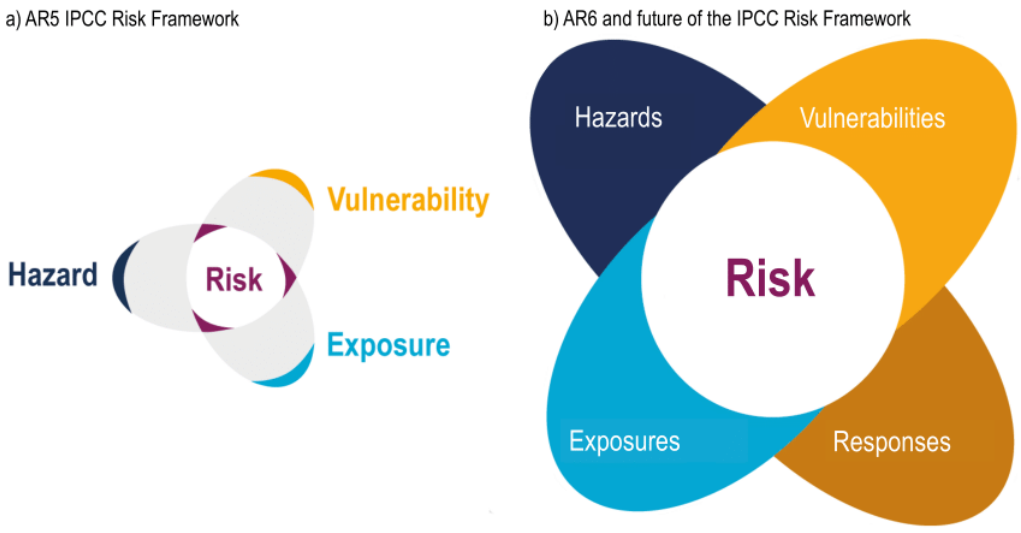
The scope of this document is to provide partners of the MISSION CE CLIMATE project with a usable methodology that can support their efforts in performing a dashboard-style climate risk and vulnerability assessment in their target area.

Planning adaptation and building resilience at the local level requires understanding the current and projected climate hazards, the exposed and vulnerable sectors of the city/area and the scale of adaptation achieved.

Climate risk and vulnerability are not directly measurable characteristics of a system, such as a temperature or precipitation, but rather concepts that express the complex interaction of different factors that determine a system's susceptibility to the impacts of climate change.

A Climate Risk and Vulnerability Assessment (RVA) determines the nature and extent of climate risks by analysing potential climate hazards, exposure to them, and vulnerability of receptors (people, communities, livelihoods, property, ecosystems) to potential threat or harm, as well as analysing adaptation responses or scale of adaptation in each context.

There is a constant development of thought in climate and vulnerability risk assessment. Intersectional and complex interactions among drivers of risk and vulnerability are reflected in the IPCC AR6 risk framework through 4 key categories: Hazards, Vulnerability, Exposure and Responses (scale of adaptation).



Source: Simpson, Nicholas et al. (2022). White Paper II: Impacts, vulnerability, and understanding risks of climate change for culture and heritage (ICOMOS).

Definition:

- Hazards: The potential occurrence of a natural or human-induced physical event or trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and

environmental resources. In this report, the term hazard usually refers to climate-related physical events or trends or their physical impacts. (IPCC)

- Exposures: The presence of people, livelihoods, species or ecosystems, environmental functions, services, resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected. (IPCC)
- Vulnerabilities: Vulnerability is "the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes.[4] The vulnerability of ecosystems and people to climate change differs substantially among and within regions (very high confidence, driven by patterns of intersecting socioeconomic development, unsustainable ocean and land use, inequity, marginalisation, historical and ongoing patterns of inequity such as colonialism, and governance. Human and ecosystem vulnerability are interdependent. (IPCC, AR6)

Responses/ Adaptation: Adaptive responses to current climate change are about reducing climate risks and vulnerability, mostly via adjustment of existing systems. Many adaptation options exist and are used to help manage projected climate change impacts, but their implementation depends upon the capacity and effectiveness of governance and decision-making processes. These and other enabling conditions also support climate-resilient development. (IPCC, AR6)

Image: Example of climate change impacts on mental health and adaptation responses in North America

Source: IPCC AR6

The RVA is a valuable tool to identify, analyse and assess vulnerabilities and potential risks in cities, to inform the adjustments or transformation of current practices, strategies and plans to minimise exposure to hazards, reduce vulnerability and increase the resilience of impacted communities. Many climate risks are either directly or indirectly related to poor (or outdated) governance, design, planning

[4] McCarthy et al., 2001, p. 995

and management of services and infrastructure in cities, unbalanced development models (socio-economic pathways) that don't account for social and environmental boundaries (i.e. meeting essential social needs with a sustainable level of resource use)[5], and poor lifestyle choices of citizens.

2.1 Methodology

A variety of methods exist for conducting the RVA assessments.

For this project, we propose the use of the following ones:

- **MISSION CE CLIMATE Dashboard RVA Assessment** - Assessment based on the MISSIONS CE CLIMATE indicator framework developed within the project (as explained below). This holistic RVA assessment is based on a broad set of indicators pointing to each territory's relative strengths and weaknesses. The indicators span four dimensions: hazards, exposure, vulnerability, and adaptation responses (capacities).
- *Risk Systemicity Questionnaire (optional)*
- *Quick Risk Estimation (optional)*

Since the MISSION CE CLIMATE project strives to work and build local resilience capacities to climate change on a systemic level, the approach proposed for the vulnerability assessment aligns with this thinking.

As stated in the EU Missions Adaptation to Climate Change Implementation Plan, for the overall EU Mission to accelerate transformative change, particular attention must be paid to generating conditions that enable such change (e.g. enabling conditions).

The primary purpose of the MISSION CE CLIMATE risk and vulnerability assessment is, therefore, to support local teams in identifying relative strengths and weaknesses of current conditions in their target area so that they can, in the following steps, design meaningful plans and implement impactful measures for strengthening resilience, mitigating climate risks, and reducing vulnerabilities.

Aligned with this thinking, the MISSION CE CLIMATE RVA does not aim to derive a singular RVA score for any given sector, risk or a distinct RVA score for the target areas (city, region, etc.)[6] but rather to provide a sound, science-based framework that will support local teams in exploring multi-dimensional and interrelated local risk and vulnerability context, across four core dimensions with the support of the MISSION CE CLIMATE Indicator Framework.

The four dimensions are as follows:

[5] Derives from Doughnut Economics theory - https://www.kateraworth.com/doughnut/#

[6] Using the impact-chain-based indicator assessment or spatially explicit RVA assessments[6] is still an option in addition to the MISSION CE CLIMATE RVA assessment. For guidance on these approaches, see:

https://www.adaptationcommunity.net/download/va/vulnerability-guides-manuals-reports/vuln_source_2017_EN.pdf

https://climate-adapt.eea.europa.eu/en/knowledge/tools/urban-ast/step-2-0

https://eu-mayors.ec.europa.eu/en/resources/reporting

- The vulnerabilities are explored by analysing and assessing socio-economic conditions, governance and developmental pathways pursued. These conditions can either be an obstacle or an enabler of climate adaptation and, more broadly, enablers of transformative changes needed to form resilient communities in the face of escalating global challenges (climate change is but one).
- Responses and adaptation capacities are explored and assessed through indicators on human, community and institutional agency, state of preparedness for hazards, financial and economic capabilities, and natural resources integrity.
- Suggested hazards to be assessed are heat, floods, water scarcity, landslides, wildfires and extreme weather events.
- An exposure risk needs to be determined for each hazard, likewise through a set of predetermined indicators.

The simple dashboard-style assessment approach should also provide a helpful platform for initiating a joint, participatory assessment process with local stakeholders[7].

The primary purpose of the dashboard format assessment is to identify the strengths to be nurtured, highlight "red-alert" areas where improvement is most acutely needed, identify critical cross-dimensional drivers that could lead to progress across all categories, and inform further sector or risk-specific analysis and policy action. For example, a specific indicator may point to vulnerabilities or bottlenecks despite a good situation in other areas of the same category. Overall, different climate risks are represented by multiple indicators across outlined categories. It is thus essential to look at all indicators simultaneously to understand the underlying complexity and get an overview of the breadth of interventions needed across different areas (social, economic, institutions, finance, data, etc.).

MISSION CE CLIMATE RVA indicators framework is a tool developed within this project to provide a meaningful basis for data-gathering, knowledge building, constructive cross-sectoral discussions, and joint assessment of local conditions by local Climate Missions[8].

The local MISSION CE CLIMATE RVA will provide the foundations for the development/improvement of local adaptation strategies and action plans planned in the project's next steps.

Furthermore, the intention of the participatory assessment process based on the proposed methodology is to support relationship-building between local stakeholders. In addition, such an assessment process should enable the development of a shared understanding of the core areas needing adaptation interventions through joint exploration of challenges and strengths of the local system.

2.2 MISSION CE CLIMATE Indicator Framework

The MISSION CE CLIMATE Indicator Framework has been developed through an extensive literature review. It represents a composite of selected indicators deriving from various resilience, climate-related RVA, and climate adaptation-related frameworks. Its development focused on selecting indicators that

[7] This can be a part of Climate Missions activation processes
[8] Missions will function as climate resilience living labs and will co-create and design climate resilience strategy and local action plans

align well with assessing local conditions and systems that can enable more adaptive and resilient communities.

Core indicator frameworks used:

- Resilience Dashboard[9]
- RESIN Risk Typology (EU Climate Risk Typology Map)[10]
- EEA Urban Adaptation Indicators[11] (Map[12])
- Resilience Maturity Model[13]
- Sustainable Development Goals Indicators[14]
- Eurostat Environment Indicators[15] & Regions and Cities Indicators[16]

The MISSION CE CLIMATE Indicator Framework (tool) is an Excel spreadsheet with separate worksheets for Hazard Indicators, Exposure Indicators, Vulnerability Indicators and Response / Adaptive Capacities Indicators.

The assessment is done by gathering the latest data for each indicator and illustrating the relative position of the data point based on the selected scoring method (usually relative ranking based on specific data range) from high to low as follows.

Suggested illustration of the indicator score					
Hazard/ Exposure / Vulnerability	Highest	Medium-high	Medium	Medium-low	Lowest
Responses /Capacities	Highest	Medium-high	Medium	Medium-low	Lowest

The MISSION CE CLIMATE RVA framework Excel spreadsheet is attached as an Annex to this guide.

Users are encouraged to add any indicators relevant to their context currently not included in the framework. The proposed framework should not be considered exclusive to further suggestions or conclusive because it is an evolving tool. New knowledge is constantly generated in the climate change field and in developing innovative indicators and datasets related to adaptation and resilience.

[9] https://commission.europa.eu/strategy-and-policy/strategic-planning/strategic-foresight/2020-strategic-foresight-report/resilience-dashboards_en
[10] https://european-crt.org/map.html
[11] https://climate-adapt.eea.europa.eu/en/knowledge/tools/urban-adaptation/Urban-Adaptation-viewer-datasets
[12] https://climate-adapt.eea.europa.eu/en/knowledge/tools/urban-adaptation
[13] https://smr-project.eu/tools/maturity-model-guide/resilience-maturity-model/
[14] https://ec.europa.eu/eurostat/web/sdi/database
[15] https://ec.europa.eu/eurostat/web/environment/database
[16] https://ec.europa.eu/eurostat/web/regions-and-cities

3 Structure of the RVA

The proposed structure of the RVA reports is as follows:

1.1. STEP 1: Analysing past and present climate impacts

Analysing the present climate and learning more about the extreme weather events that have happened in the past helps cities/regions better understand the climate risks they currently face. By identifying long-term trends, they can also see how their areas might be affected by climate change impacts in the longer term when the present risks are intensified.

Most urban areas are affected by more than one hazard, and the most recurrent impacts in EU cities are:

- Heat waves on human health.
- Droughts on water management.
- Inland and/or coastal floods - due to storm surges and heavy rainfalls - affect people, infrastructure, buildings, and services.[17]

Information about local past extreme weather events, such as flooding, heatwaves or wildfires, may be collected and maintained by national or regional civil protection or disaster management authorities, the national meteorological service, or an environmental agency. It can be helpful to consult local departments such as transport, public health, or infrastructure, which may be able to provide information about the types of climate-related hazards that have affected their area the most.[18]

Urban Adaptation Map Viewer provides an overview of the current and future climate hazards facing European cities and regions, the sensitivity of the cities/regions to these hazards and their adaptive capacity. The map viewer collates information from various sources on the observed and projected spatial distribution and intensity of high temperatures, flooding, water scarcity, wildfires, and vector-borne diseases.

Main activities of defining climate hazards for the city

- Gather data about past and current climate-related impacts through desk research and consultations with local stakeholders and corresponding agencies.

3.1 STEP 2: Analysing climate projections and future impacts (hazards)

Adaptation plans and measures must consider the potential future impacts of changing climate conditions. Many future climate impacts will likely be caused by more frequent and extreme versions of the current extreme weather events. However, new hazards and impacts may also occur. Accessing and correctly interpreting information about the projected climate impacts is crucial to develop a long-term adaptation strategy.[19]

There are many easily accessible sources of information about climate change projections and data in Europe, such as:

[17] Tapia et al. (2017)
[18] https://climate-adapt.eea.europa.eu/en/knowledge//tools/urban-ast/step-2-1
[19] https://climate-adapt.eea.europa.eu/en/knowledge/tools/urban-ast/step-2-2

- European Climate Data explorer[20]
- Adaptation Dashboard[21]
- IPCC WGI Interactive Atlas[22]
- IPCC Data Distribution Centre[23]
- Copernicus Climate Data Store[24]
- Climate Change Knowledge Portal[25]
- EEA and other European agency's technical reports (The Lancet Public Health study26)
- National and international meteorological centres and the European Centre for Medium-Range Weather Forecasts

For more information, consult this ClimateADAPT page.

Main activities for defining future climate hazards:

- Identify climate threats for the target area based on short, mid and long-term projections and scenarios.

3.2 STEP 3: Conducting Indicator-Based RVA using the MISSION CE CLIMATE TOOL

Climate impacts affect different areas and populations within a city/region, and the consequences depend on specific socio-economic and institutional conditions (e.g. enablers or barriers) relevant to the impact at stake.

MISSION CE CLIMATE Indicator Framework has been developed to provide the basis for the local Dashboard RVA assessment and to support the exploratory climate impact analysis with local stakeholders.

It provides a meaningful basis for data gathering, knowledge building, constructive cross-sectoral discussions, and joint assessment of local conditions by local Climate Missions[27].

The MISSION CE CLIMATE Indicator Framework (tool) is attached as an Annex.

Users are encouraged to add indicators relevant to their context and currently not included in the framework.

A vital part of the local RVA assessment is the Exploratory analysis with key stakeholders.

This step usually includes a (series of) workshops/meetings with city stakeholders to explain the RVA approach and the required data, contextualise the assessment, understand the needs and

[20] https://climate-adapt.eea.europa.eu/en/knowledge/european-climate-data-explorer
[21] https://climate-adapt.eea.europa.eu/en/mission/knowledge-and-data/data-dashboards
[22] https://interactive-atlas.ipcc.ch/
[23] https://www.ipcc-data.org/
[24] https://cds.climate.copernicus.eu/#!/home
[25] https://climateknowledgeportal.worldbank.org/
[26] https://www.thelancet.com/journals/lanpub/article/PIIS2468-2667(22)00197-9/fulltext
[27] Missions will function as climate resilience living labs and will co-create and design climate resilience strategy and local action plans

expectations of diverse stakeholders, discuss selected indicators, their relevance, ranking methods, impact scores, identify missing data and indicators, etc.

Such a participatory assessment approach can benefit from cross-sectoral diversity and provide space for critical multi-perspective discussion. As a result, this can support the development of a shared understanding of challenges and opportunities in adaptation to climate change and resilience building.

Main activities of the exploratory analysis and RVA process:

- Primary information sources such as city agencies, civil protection, utility companies, and universities are mapped.
- The best scale of analysis (e.g. city, municipality, region) is selected.
- Initial data gathering and processing.
- Stakeholder engagement (e.g. through local Climate Missions) and use of MISSIONE CE CLIMATE indicator framework, Risk Systemicity Questionnaire and Quick Risk Estimation tool in the participatory assessment process.
- Qualitative understanding of the target area's specificities and climate change impacts.
- A contact point for communication and data sharing with local authorities and other relevant stakeholders is established.
- Indicator adaptations.
- Vulnerability and risk scores are assessed.

3.3 STEP 4: Understanding the role of surrounding areas in adaptation

Cities cannot be treated in isolation from the regions surrounding them. Settlements depend on both their immediate and further surroundings for various climate-sensitive services and products: agricultural food production, water supply, infrastructure networks, energy production, waste and wastewater management, forestry materials, recreation opportunities and others. Therefore, climate change impacts that might not directly impact the city or town can still have severe repercussions if they hit the area providing these services. Vice versa, climate impacts in the city (e.g. flooding) can affect the surrounding areas if access to urban jobs, resources and various services is disrupted. Thus, the adaptation of a city requires an integrated approach that considers the rural-urban interface and wider surrounding areas. To ensure resilience, collaboration with neighbouring administrations may be required.[28]

Main activities for understanding the role of surrounding areas:

- Identify core interdependencies with surrounding areas.
- Seek collaboration with relevant stakeholders from those areas.

3.4 STEP 5: Identifying main adaptation concerns and defining objectives.

This step aims to develop a strategic direction for adaptation planning based on assessing climate-related risks and vulnerabilities. Identifying the main adaptation concerns is based on analysing the

[28] https://climate-adapt.eea.europa.eu/en/knowledge//tools/urban-ast/step-2-5

immediacy and severity of impacts and on the opportunities to leverage existing adaptive capacity strengths or the current resource and infrastructure management arrangements and plans.[29]

In general, the main issues to be considered in prioritising which climate impacts to address include:

- Already occurring impacts, in particular, the ones projected to worsen in the future.
- Serious risks that might affect the city irreversibly (e.g. sea level rise).
- The likelihood and severity of impacts in the future.
- Critical vulnerabilities and strengths (activated adaptive capacities).
- Existing mechanisms aligned with adaptation actions (e.g. refurbishment of the housing stock, spatial planning, etc.) could provide valid entry points for action.
- Mainstreaming adaptation into existing or planned initiatives could begin with examining how the vulnerable sectors currently respond to climate- and weather-related hazards and through discussions with various departments in the municipality and the key stakeholders.
- Setting the adaptation priorities in joint agreement (engagement of stakeholders).
- Establish whether the risk is within the municipality's or engaged stakeholders' mandate and thus could be addressed through administrative arrangements.

Main activities of identifying main adaptation concerns:

- Summarise key findings from the RVA assessment and outline key adaptation concerns.

Once the main adaptation concerns are known, specific and realistic goals for the city or town can be defined, leading to the development of a climate resilience strategy and action plan.

4 Additional Assessment Methods (optional)

The two optional methods to be deployed in the RVA process are the Risk Systemicity Questionnaire and Quick Risk Estimation. Both methods can be valuable to local RVA assessment efforts as they propose exploring risk and vulnerabilities through somewhat different angles/lenses.

Both tools are simple to use. However, both require a participatory assessment approach that builds on cross-sectoral diversity and provides space for critical multi-perspective discussion. As a result, they support the development of a shared understanding of challenges and opportunities in the area of adaptation to climate change and resilience building.

4.1 Risk Systemicity Questionnaire

The Risk Systemicity Questionnaire (RSQ) is an Excel-based tool where users are asked to consider the relative likelihood of a broad range of risks in their cities, including the risks brought about and exacerbated by climate change. Based on the responses to the questions in each of the topics of the RSQ, participants are provided with a relative risk score (an estimated risk level for the city). In addition,

[29] https://climate-adapt.eea.europa.eu/en/knowledge//tools/urban-ast/step-2-6

users can access policy recommendations that may be used to address those risk scenarios that are the most threatening to the city. The purpose of the questionnaire is for it to be used by groups of users with diverse areas of expertise to prompt valuable discussions where different stakeholders' experiences can be brought together to determine a city's priorities to enable them to anticipate and appropriately respond to future challenges.

This tool is well suited for initiating cross-sectoral discussions at the level of local Climate Missions. The questionnaire is designed in Excel and is easily navigable. It is based on various scenarios of possible futures in cities/regions. Some topics listed might be more relevant than others regarding their relation to climate change risks. Missions can choose which topics to focus on.

The RSQ supports cities in "actively understanding the risk landscape" by improving their risk assessment beyond traditional methods through an innovative focus on the interactions between different types of risks.

The RSQ Excel file and manual[30] will be provided to all project partners to support their RVA development. The web version of the questionnaire is available on this site: https://rsq.smr-project.eu/.

4.2 Quick Risk Estimation

The Quick Risk Estimation (QRE) tool helps identify and understand current and future risks/stress/shocks and exposure threats to human and physical assets. The QRE Tool is not a full-scale risk assessment but a multi-stakeholder engagement process to establish a common understanding. The QRE Tool must be used in a workshop environment in a multi-stakeholder approach, not by an individual accessor.

As such, it is a tool that is well suited for initiating cross-sectoral discussions of local Climate Missions to jointly identify the most relevant local hazards, discuss and jointly assess, through predefined risk matrix and rating scales, local vulnerability, and exposure ratings for various sectors (infrastructure, essential services, communities, productive sector).

Once the required input data is appropriately inserted into the tool (Excel Sheet), the tool produces a Risk Summary and Vulnerability Report in a dashboard style, advising the risks and hazards to human and physical assets at the specified location.

The QRE tool uses the hazard classification outlined by the United Nations Office for Disaster Risk Reduction (UNDRR). The hazard indicators included in the QRE tool are aligned with the 10 Essentials for Making Cities Resilient Scorecard in the context of the Sendai Framework for Disaster Risk Reduction 2015 - 2030 and the Sustainable Development Goals.

The QRE tool (Excel file) will be provided to all project partners to support their RVA development.

The tool can also be accessed online at:

https://www.unisdr.org/campaign/resilientcities/toolkit/article/quick-risk-estimation-qre.html

[30] https://smr-project.eu/fileadmin/user_upload/Documents/Resources/WP_3/SMR-RSQ-manual-WWW.compressed.pdf