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WORKSHOP

AGREEMENT

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City Resilience Development - Guide to combine disaster risk management and climate change adaptation - Historic areas

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Contents
Page

European foreword

This CEN Workshop Agreement (CWA 17727:2022) has been developed in accordance with the CEN-CENELEC Guide 29 "CEN/CENELEC Workshop Agreements – A rapid prototyping to standardisation" and with the relevant provisions of CEN/CENELEC Internal Regulations – Part 2. It was approved by a Workshop of representatives of interested parties on 2022-04-28, the constitution of which was supported by CEN following the public call for participation made on 2021-04-22. However, this CEN Workshop Agreement does not necessarily include all relevant stakeholders.

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Introduction

Resilience of historic areas

While negative impacts of climate-related and other hazards on urban areas are widely discussed in contemporary literature and research, their impacts on cities and communities, which are inextricably linked to historic areas, have not yet been studied extensively. Combined work on disaster risk reduction and climate change adaptation in and for historic areas, with their unique structure, calls for advanced technologies, models, methods, processes and tools. To make a historic area resilient, the local community, municipal staff, practitioners and decision-makers need to address both the chronic stresses posed by climate change as well as the shocks and existing risks posed by other disasters. However, to date, typical management frameworks for disaster risk management (DRM) and climate change adaptation (CCA) still consider shocks and chronic stresses in isolation. Furthermore, the term "city resilience" or additionally, "community resilience" can mean many different things to different actors, depending on the context in which it is applied.

The ARCH DRM/CCA Framework

The aim of the CEN/WS ARCH, a temporary working group, was to further develop the ARCH Project's DRM/CCA Framework, together with a broader community of experts, including municipal staff. The framework was created to help, for example, practitioners, decision-makers, heritage managers, public administrators, and other actors in the field of DRM, CCA, and historic area management to:

– acknowledge the need for socially just resilience building activities,

– understand which steps are necessary to develop a Resilience Action Plan that combines DRM and CCA processes and that takes into account the needs and opportunities of historic areas when building resilience,

– provide guidance on how to operationalize the different steps of the DRM/CCA Framework,

– provide guidance on which stakeholders to involve in each step of the DRM/CCA Framework,

– provide a conceptual structure for the use of different supporting tools and materials within the steps of the DRM/CCA Framework.

The content in this document is based on the DRM/CCA Framework of the ARCH project, which centres on historic areas. Nonetheless, the DRM/CCA Framework can also be applied to other use cases in other parts of a given city, not necessarily only on historic areas.

The framework is based on the DRM cycle proposed by Jigyasu, King, and Wijesuriya in the UNESCO manual on managing disaster risk for world heritage [1] as a starting basis and extends it with the climate change adaptation planning cycle of Climate ADAPT's Urban Adaptation Support Tool [2]. This combined planning cycle is then further extended with considerations from topic-specific frameworks relevant to historic areas, like the Culture in City Reconstruction and Recovery Framework [3], the SMR European Resilience Management Guideline [4], and the RESIN Conceptual Framework [5].

CWA 17300 series on "City Resilience Development"

This document complements the already existing standards series CWA 17300 on "City Resilience Development". This supports the uptake and consideration of the standards content in relation to enhance resilience in cities and communities. The standards series consists of the following documents:

– CWA 17300 *City Resilience Development – Operational Framework*

– CWA 17301 *City Resilience Development – Maturity Model*

– CWA 17302 *City Resilience Development – Information Portal*

The CWA on Operational Guidance is the overarching document that refers to the CWA 17301 *City Resilience Development – Maturity Model*, the CWA 17302 *City Resilience Development – Information Portal*, as well as to other supporting tools.

Technical Committees

The cross-sectoral topic of disaster risk management and climate change adaptation of historic areas is discussed in the following Technical Committee:

– CEN/TC 346 *Conservation of cultural heritage,*

– ISO/TC 292 *Societal and citizen security,*

– ISO/TC 268 *Sustainable cities and communities,*

– ISO/TC 207/SC 7 *Greenhouse gas and climate change management and related activities.*

Wherever possible, the document refers to existing standards from the above mentioned Technical Committees.

1 Scope

The document specifies a resilience-building framework for historic areas within cities and communities that defines and combines disaster risk management (DRM) and climate change adaptation (CCA) activities in an integrated approach. The framework is applicable for historic areas that face natural and climate change-induced hazards. The framework includes a:

– characterisation of historic areas and their exposure to natural and climate change-induced hazards,

– set of requirements and recommendations on how historic areas can become more resilient,

– step-by-step process to manage disasters, and to perform and monitor resilience-building activities.

This document is intended to be used by decision makers and technical staff at the city/community and historic area levels, as well as by councillors working on risk and vulnerability assessment, climate change adaptation and resilience enhancement. Other stakeholders who may wish to use the document include disaster risk managers, heritage managers, public administrators, sustainability and resilience officers, critical infrastructure managers, service providers, emergency service providers, civil society associations, non-governmental organisations, academic and research institutions, as well as consultancies.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardisation at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
chronic stress
underlying human and natural pressure or tension that causes persistent negative impacts relating to environmental degradation, social inequality and economic instability

[SOURCE: ISO 37123:2019, definition 3.9, modified — "chronic" was added, "in a city" and the examples were deleted]

3.2
city
human settlement formed by a central area, neighbourhoods and suburbs reciprocally connected but not necessarily coincident with administrative boundaries, and inclusive of all the urban stakeholders that play key roles in its functioning

[SOURCE: CWA 17300:2018, definition 3.5]

3.3
climate change
change in climate that persists for an extended period, typically decades or longer

NOTE 1 to entry:to entry: Climate change can be identified by such means as statistical tests (e.g. on changes in the mean variability).

NOTE 2 to entry:to entry: Climate change might be due to natural processes, internal to the climate system, or external forcing such as modulations of the solar cycles, volcanic eruptions, and persistent anthropogenic changes in the composition of the atmosphere or in land use.

[SOURCE: ISO 14090:2019, definition 3.5]

3.4
climate change adaptation
process of adjustment to actual or expected climate and its effects

NOTE 1 to entry:to entry: In human systems, adaptations seeks to moderate or avoid harm or exploit beneficial opportunities.

NOTE 2 to entry:to entry: In some natural systems, human intervention can facilitate adjustment to expected climate and its effects.

[SOURCE: ISO 14090:2019, definition 3.1]

3.5
disaster
situation where widespread human, material, economic or environmental losses have occurred which exceeded the ability of the affected organisation, community or society to respond and recover using its own resources

[SOURCE: ISO 22300:2021, definition 3.1.73]

3.6
disaster risk reduction
application of policies aimed at preventing new and reducing existing disaster risk and managing residual risk, all of which contribute to strengthening resilience and therefore to the achievement of sustainable development

[SOURCE: ISO 22300:2021, definition 3.1.74, modified — "policy aimed" changed to "application of policies aimed"]

3.7
emergency
sudden, urgent, usually unexpected occurrence or event requiring immediate action

EXAMPLE   Child falls into a fast running river.

[SOURCE: ISO 22300:2021, definition 3.1.87, modified — example was added]

3.8
framework
system of requirements and recommendations designed to support the accomplishment of disaster risk management and *climate change adaptation* (3.4)

3.9
hazard
source of potential harm

[SOURCE: ISO 22300:2021, definition 3.1.110]

3.10
historic area
any group of buildings, structures and open spaces including archaeological and paleontological sites, constituting human settlements in an urban or rural environment, the cohesion and value of which, from the prehistoric, archaeological, architectural, industrial, historic, aesthetic or sociocultural point of view are recognized

EXAMPLE   Prehistoric sites, historic towns, old urban quarters, villages and hamlets as well as homogeneous monumental groups.

[SOURCE: Adapted from UNESCO Recommendation Concerning the Safeguarding and Contemporary Role of Historic Areas. Nairobi, 1976]

3.11
historic urban landscape
urban area understood as the result of a historic layering of cultural and natural values and attributes, extending beyond the notion of "historic centre" or "ensemble" to include the broader urban context and its geographical setting

[SOURCE: UNESCO. (2011). Recommendation on the Historic Urban Landscape adopted by the General Conference at its 36th session]

3.12
impact
evaluated consequence of a particular outcome

[SOURCE: IEC 62443-3-3 Corrigendum 1:2014, definition 3.1.27]

3.13
resilience
ability of a *historic area* (3.10) as a *social-ecological system* (3.21) to cope with *hazard* (3.9) by responding and adapting in socially just ways that maintain the historic area's functions and heritage significance (including identity, integrity, authenticity)

3.14
resilience action plan
plan outlining actions to improve a long-term or overall resilience objective

[SOURCE: ISO 9000:2015, definition 3.5.12, modified — "resilience", "outlining actions" was added]

3.15
resilience building process
sequence of *resilience* (3.13) enhancing activities

3.16
risk
effect of uncertainty

NOTE 1 to entry:to entry: An effect is a deviation from the expected. It can be positive, negative or both. An effect can arise as a result of a response, or failure to respond, to an opportunity or to a threat to objectives.

NOTE 2 to entry:to entry: Uncertainty is the state, even partial, of deficiency of information related to, understanding or knowledge of, an event, its consequence, or likelihood.

[SOURCE: ISO 14090:2019, definition 3.12]

3.17
risk assessment
overall process of risk identification, risk analysis and risk evaluation

[SOURCE: ISO 22300:2018, definition 3.203]

3.18
risk mitigation
lessening or minimising of the adverse impacts of a hazardous event

[SOURCE: ISO 22300:2018, definition 3.1.225]

3.19
risk prevention
process of either avoiding risks or reducing their probability

3.20
shock
natural or man-made event that causes a *disaster* (3.5)

EXAMPLE   Flood, earthquake, volcanic eruption, hurricane, wildfire, pandemic.

[SOURCE: ISO 37123:2019, definition 3.8]

3.21
social-ecological system
SES
complex system of people and nature, emphasizing that humans are seen as a part of, not apart from, nature

[SOURCE: Berkes, F., Folke, C., & Colding, J. (Eds.). (2000). Linking social and ecological systems: management practices and social mechanisms for building resilience. Cambridge University Press.]

3.22
sustainability
ability of a system to be maintained for the present and future generations

[SOURCE: EN 16627:2015, definition 3.62]

3.23
vulnerability
intrinsic properties of something resulting in susceptibility to a risk source that can lead to an event with a consequence

[SOURCE: ISO Guide 73:2009, definition 3.6.1.6]

4 Characterisation of historic areas

This clause defines a template that should be filled out by the end users of the document to characterise the historic area of concern and the hazards it faces. The template assumes an understanding of a historic area as a social-ecological system (see Figure 1) that consists of the built and natural environments which make up the ecological system, and the social, cultural, economic, and policy aspects which make up the social system. These two subsystems are related to each other, with the ecological system providing functions and services to the social system and the social system conducting interventions on the ecological system. It is important to note that the social and ecological systems, as well as their elements, cannot be viewed independently from each other, but as interrelated and partially overlapping [6][7].
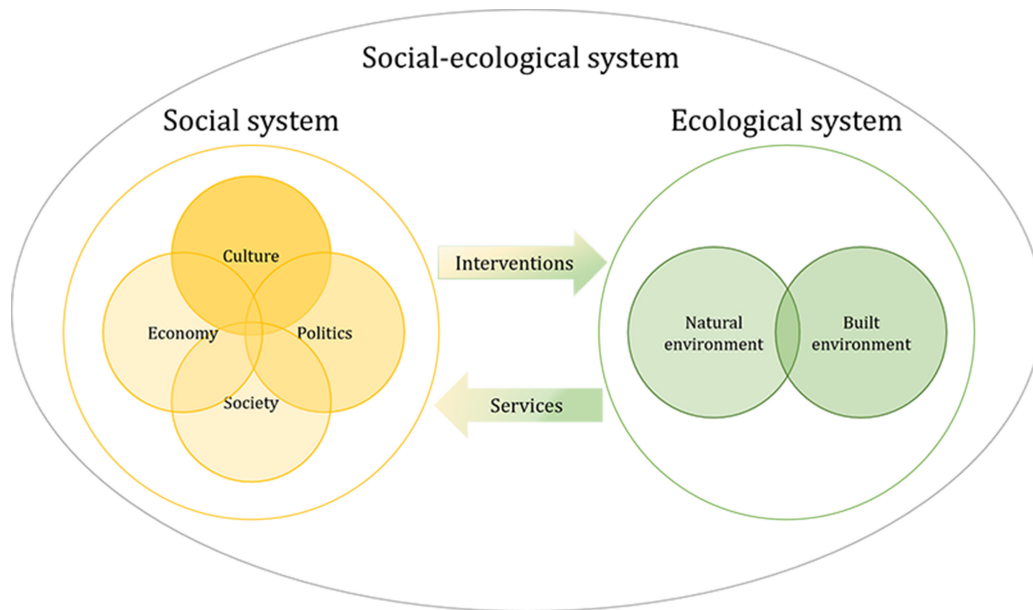
Figure 1 — Social-ecological system (SES) [7]

The term historic area represents different heritage concepts such as Historic Urban Landscapes (HUL), cultural landscapes, archaeological sites and others. Their specific assessment and the definition of cultural heritage values as well as requirements are brought into the CEN Workshop Agreement within Step 1 and 2 of the DRM/CCA Framework (see clause 5). These concepts should be established independently and prior to this CEN Workshop Agreement, and they follow a set of rules of the different concepts (e.g. HUL and Cultural Landscapes as defined by UNESCO World Heritage Committee).

The template provided in Annex A should be used to describe the historic area in terms of its subsystems and constituent elements. These include:

– ecological subsystem elements (e.g. built and natural environment, supporting infrastructures and services, movable heritage),

– social subsystem elements (e.g. intangible heritage features, economic features, policy context),

– the functions and uses of the historic area, as well as

– risk information (e.g. hazards, exposed elements, vulnerability, impacts) about the historic area.

When characterising a historic area using the template, all subsystems and their constituent elements that are essential for the functioning of the historic area, as well as for its cultural significance, should be identified and described in detail at the appropriate section of the template. To do so, local examples for specific subsystem elements and characteristics should be given.

The identification of subsystems and elements should be done in consultation with local experts and community groups to ensure that all aspects relevant for the local population are included in the characterisation.

5   General information

This clause introduces the overall DRM/CCA Framework (see Figure 2) and how the steps and phases are connected to one another. The DRM/CCA Framework consists of ten steps spread across the three phases:

– pre-disaster phase,

– during-disaster phase, and

– post-disaster phase.
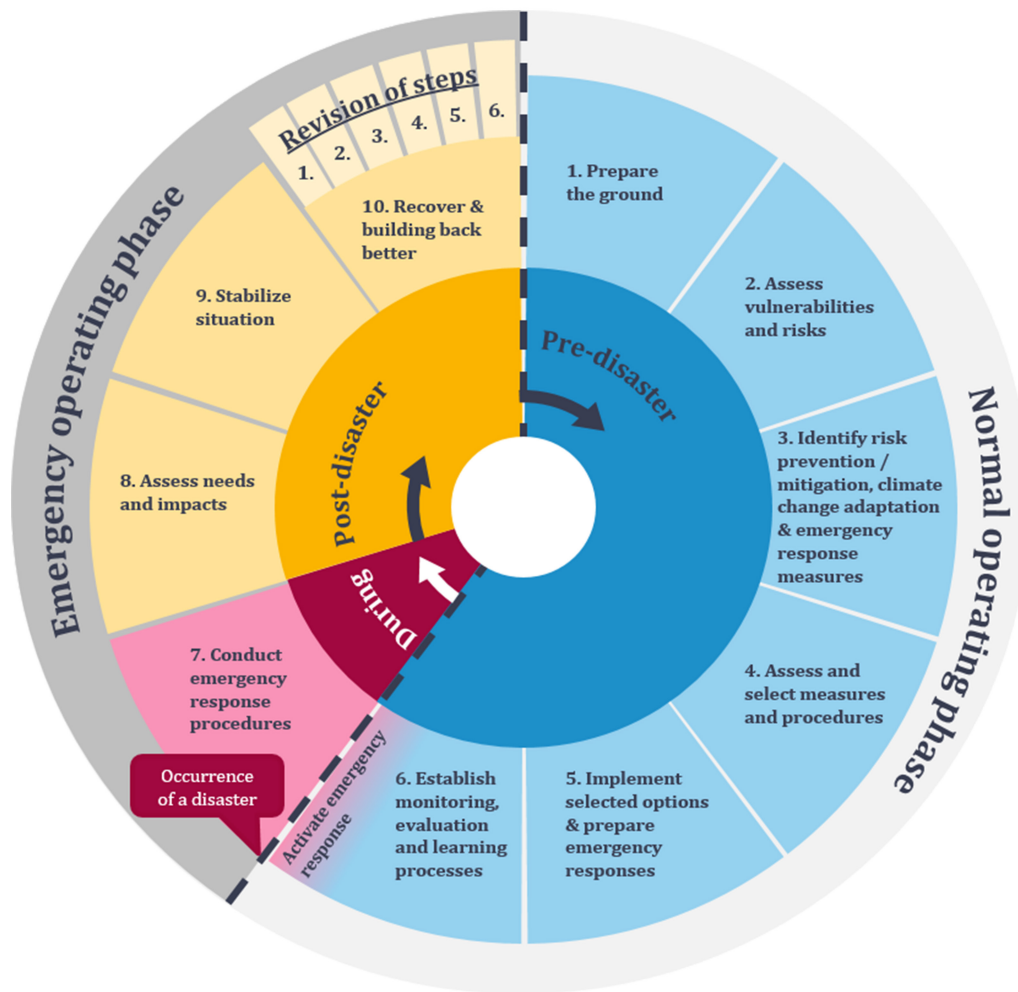
Figure 2 — DRM/CCA Framework

Resilience building cannot be pursued without having a structured cyclical process in place. The ten steps shall be understood as consecutive but not completely distinct working stages, since they have strong interconnections and related actions.

In case no disaster occurs, the steps of the normal operating phase (pre-disaster phase) shall be regularly repeated. Therefore, the first six steps are set to be repeated in regular cycles subject to specific city needs.

In the case of a disaster, the cyclic process is disrupted, and the emergency operating phase (during and post-disaster phases) shall be initiated (see Figure 2).

In an ideal scenario, activities towards a combined DRM and CCA approach might already have been initiated within the historic area, meaning that certain steps might already have been (partially)

conducted. In other words, preparation may have laid the foundation for emergency operating phase activities even before the onset of the disaster. In either case, the steps in the emergency operating phase depend on the preparatory plans and actions resulting from the normal operating phase. Approaches used in the normal operating phase can set communities up for better outcomes in the event of a disaster.

Within the post-disaster phase, a revision of actions from the pre-disaster phase shall be included to account for the need to adjust actions based on outcomes of actions taken in the emergency operating phase. The post-disaster phase shall be used to re-assess measures in order to support building back better and further strengthening the resilience of the historic area.

The indicators in Annex B can be used to measure progress and completion of the activities described in each of the consecutive steps of the DRR/CCA Framework.

6 Pre-disaster – Normal operating phase

6.1 Prepare the ground

6.1.1 General information

This subclause provides information on Step 1 of the DRM/CCA Framework.

The first step aims at building a basis for the subsequent steps by identifying objectives, scope, and responsibilities as well as relevant stakeholders that should be involved in the resilience building process from the outset. This step also includes the collection of initial information and data. In other words, the first step lays the groundwork for operationalising resilience, while assessing the present resilience condition of a community and its historic areas.

In fulfilling this step, the city establishes an assessment context that will later serve as the basis for setting priorities and goals for the collaborative development of a resilience strategy, as well as for monitoring progress through the use of indicators for resilient communities and historic areas.

6.1.2 Requirements

This subclause provides requirements that have to be met to successfully perform Step 1 of the DRM/CCA Framework, *Prepare the ground*.

– The community and its historic areas shall engage in the **formation of a cross-sectoral resilience team or office** that works on the resilience-building process and is responsible for issues, challenges, and opportunities related to resilience. The team or office shall be responsible for mainstreaming resilience into traditional community practices and communicating about resilience building activities to local stakeholders. The resilience team takes on ownership and is thereby accountable for the resilience action plan development. The responsibilities among the team for the resilience building process shall be clarified and a communication process shall be established.

   NOTE 1   Cross-sectoral resilience team or office, hereafter only referred to as resilience team.

   NOTE 2   The resilience office is defined in CWA 17300 *City Resilience Development – Operational Guidance* as: "A resilience office, based on the resilience team, but enhanced with staff from different departments at city level, should be set up in order to perform and monitor the implementation of the resilience strategy. The resilience office should be either a whole department (with permanent/full time personnel) or a committee (with city personnel from different sectors or departments that will hold regular meetings)."

– Initial **data and key information** (incl. processes and legislation) **about the community and historic area shall be collected** and reviewed to inform decision makers on objectives and scope of the resilience building process (see Annex A).

EXAMPLE   Data may include, location and size of the historic area, information on ownership for buildings within the area, structural information on buildings, but also information on social, cultural and natural aspects related to the area, like existing community groups, associated local traditions, location and size of ecosystems, challenges and pressures that have led to the current situation, as well as the impacts those pressures have on various parts of the society, economy and environment, and the policies and measures already in place.

– **Initial data about relevant climate change related and natural hazards shall be collected** and reviewed to help limit the scope of the resilience-building process to the most relevant hazards. This might include gathering historical data about past hazards and their impacts, pre-identifying relevant climate change scenarios based on established processes and knowledge, and lastly, outlining how to assess urban risks and vulnerabilities and develop and implement options to build resilience to these risks to ensure that a community and its historic areas can achieve their goals (see Annex A).

– Available **information on all relevant aspects of sustainability, climate change adaptation and resilience shall be collected** and structured. Even if all the data (quantitative or qualitative, i.e. spatial data, data on economic and social conditions or demographic data) cannot be delivered during the first cycle of the DRM/CCA Framework, it still serves for identifying gaps.

– Initial data and **information about the available funding and personnel resources shall be collected** to be able to effectively define the scope and objectives and set soft boundaries of the resilience-building process.

– The resilience team shall **perform a stakeholder mapping and analysis**, including stakeholders and actors relevant for the historic area and beyond. The stakeholder mapping and analysis exercise shall result in an external communication and stakeholder engagement process that shall describe how and when to communicate with stakeholders on hazards and impacts, as well as how to involve them in the resilience-building process. This process shall engage stakeholders by using a participatory approach and emphasize the value of the historic area for the local communities in the communication activities. The resilience team shall use an inclusive mix of outreach options and channels.

EXAMPLE   Potential stakeholders could be related to the following places: Civil protection office, climate control centre, urban development department, health department, cultural heritage department, sustainability and resilience office, environmental department, transport department, finance department, commerce department, police and law enforcement, universities, schools, public and private research facilities, local businesses, local building owners, cultural associations, consultancies, industry associations, insurance agencies, financial institutions, non-governmental organisations.

– The **objectives and scope of the resilience-building process shall be defined**. This depends on the time and resources available to the resilience team involved in the management process and shall be based on the information collected and reviewed in advance.

– A **resilience baseline assessment** based on the gathered data and information shall be performed to evaluate the initial situation of the community and historic area. The baseline assessment is a regularly performed action conducted by the cross-sectoral resilience team. It determines the geographical and thematic scope of the DRM/CCA Framework, setting its boundary conditions.

6.1.3 Recommendations

This subclause provides recommendations on how to fulfil Step 1 *Prepare the ground*.

– The community's or historic area's **political representatives should be included in the approval of the implementation of the DRM/CCA Framework** to ensure successful advocacy, city resilience

championing, and visibility of the subsequent resilience-building activities. By ensuring early support from political leadership, resilience becomes more likely to be recognised in the city strategy and included in the planning of budgets and resources.

– The political representatives of the community and the historic areas should **share ownership of the creation of the resilience team or office** from the start, and should approve the resilience strategy development. The resilience team should consider other cities' actions or ongoing activities related to the actions, and projects to safeguard human and financial resources.

6.1.4 Supporting materials and tools

This subclause provides a selection of supporting tools and materials useful for Step 1 of the DRM/CCA Framework.

The **ARCH Resilience Assessment Dashboard** (ARCH RAD) is a web-based tool to assess how well the DRM/CCA Framework is implemented. The ARCH RAD will enable end-users to perform thorough or quick resilience self-assessments for historic areas. This tool is available here: rad.savingculturalheritage.eu (last retrieved on 28/06/2022).

Another resilience assessment tool is the **Resilience Maturity Model (RMM)** described in CWA 17301 *City Resilience Development – Maturity Model*. The RMM helps to assess the resilience status and to identify the ideal path for the evolution of the resilience-building process from an initial stage to a more advanced stage, going through a number of intermediate stages.

The proposed hazard list included in the **UNDRR's Hazard Definition & Classification Review Technical Report** might be used during the pre-identification of relevant hazards.

Meanwhile, **ARCH's Threats and Hazard Information System (THIS)** enables end-users to access geo-referenced information about historic and real-time environmental threat indicators for historic areas. **ARCH's Historic Area Information System (HArIS)** enables end-users to access geo-referenced information about historic and current conditions of historic areas. It links both 3D geometry and material information where possible, enabling structural resistance and simulated ageing analysis in combination with short and long term trends of air quality and climate data. The tool is available here: portal.savingculturalheritage.eu (last retrieved on 28/06/2022).

ISO/TS 14092 *Adaptation to climate change — Requirements and guidance on adaptation planning for local governments and communities* describes, among other things, responsibilities of a core decision team and a facilitation team that lead the adaptation planning process within the local government and community. ISO/TS 14092 also gives examples on "interested parties" that should be involved in the adaptation process. The information can help to set up the resilience team.

6.2 Assess vulnerabilities and risks

6.2.1 General information

This subclause provides information on Step 2, *Assess vulnerabilities and risks* of the DRM/CCA Framework.

This step refers to the identification and assessment of vulnerabilities and risks to identify areas of the community and historic area that require increased attention and to determine appropriate measures to address those vulnerabilities and risks. The purpose of a risk assessment is to:

– ensure that resilience-building activities are relevant to the community and historic area context,

– ensure the appropriate and proportionate investment of resources,

– better understand the exposure and vulnerability of the community or historic area to different shocks and chronic stresses,

– identify potential impacts so that capabilities can be developed to the impacts of many risks.

6.2.2 Requirements

This subclause provides requirements that have to be successfully met to perform Step 2 *Assess vulnerabilities and risks* of the DRM/CCA Framework.

– The **hazards to be further analysed shall be selected**, based on the information gathered in Step 1. The resilience team identifies and analyses hazards in more detail, as well as existing and potential future challenges related to the hazards.

– The team shall **perform a risk and vulnerability assessment**, which is an effective way to prioritise climate hazards and to create a shortlist for further analysis of risk components (hazards, vulnerabilities, and exposures). In this step, hazards and climate impacts of concern are prioritised. The risk and vulnerability assessment may also take place in workshop settings. It is worth noting that risk assessments are always subjective, as they depend on the opinions and personal experiences of those involved. It is therefore recommended to conduct the risk assessment with a broad group of representatives and preferably to repeat the exercise with relevant stakeholders to validate the priorities. The following activities are part of a regular risk assessment:

1) The **main exposed elements to consider for the vulnerability and risk assessment are selected**.

2) The **scenarios for which to conduct a risk assessment** are selected, these include climate change scenarios but also urban development scenarios and other projections with relevance to vulnerability and risk factors.

3) The **sensitivities and capacities influencing the vulnerabilities** of the different exposed elements to different hazards are identified.

4) The potential **impacts shall be identified by evaluating historic and current information**. This includes impacts on the various elements of the SES and disaggregation of information in such a way that effects on different population groups can be assessed. These impacts also cover (intangible) heritage values that can, for example, be captured by analysing the local population structure and the actual utilization of historic areas (such as in the case of cultural urban landscapes).

5) Finally, **cascading effects** shall be considered and prioritised.

– Following the performance of a risk assessment, the resilience team shall **establish a risk database and risk management system**, which will include historical data on risk scenarios, assessments and mapping of vulnerabilities. The risk database and management system shall also include detailed methodology and guidance to perform risk and vulnerability assessment.

6.2.3 Recommendations

This subclause provides recommendations on how to fulfil Step 2 *Assess vulnerabilities and risks* of the DRM/CCA Framework.

– The resilience team should **conduct a rapid assessment to identify risks and vulnerabilities** in order to provide an initial assessment of the risk profile of communities and historic areas and

initiate early action. The rapid assessment is supposed to be the basis for the more elaborate assessment.

– The resilience team should **identify, assess and map the vulnerability of affected people and communities** based on their capacity to recover and their sensitivities to the hazards in question. The following should be considered: economic and technological resources, social capital, availability of information and skills, institutional and community support systems, political and social (in) equality, access to natural resources and services, and pre-existing stresses, risks or disadvantages.

– The risk analysis should include the impacts on supporting infrastructures and services. The results should be documented in a **Vulnerability Matrix** showing the capacity and sensitivity.

– The resilience team should **bring together a multi-disciplinary group to share knowledge** about the identified risks, including the output of regular risk assessments, and to promote a systems perspective of risks by discussing risk interdependencies and the relevant consequences.

– The resilience team should **organise workshops or discussion** sessions that engage citizens, **raise their risk awareness, and lay the groundwork for risk mitigation**. As part of these workshops and sessions, participants should also receive active feedback on how their inputs have been incorporated into the process of identifying measures.

6.2.4 Supporting materials and tools

This subclause provides a selection of supporting tools and materials useful for the Step 2 of the DRM/CCA Framework.

The **ARCH Decision Support System (DSS)** is a web-based platform, which enables end-users to gain awareness and knowledge on the possible impacts that natural hazards might induce on the different dimensions of historic areas and on the effectiveness that resilience strategies might have on reducing such impacts. It uses the information provided by the ARCH HArIS and ARCH THIS for vulnerability and risk assessments under different scenarios (historic and artificial). Depending on the available data as well as the scope and resolution of the assessment, it supports quantitative as well as qualitative assessments on building, area, and territorial scale. The ARCH DSS supports the identification and assessment of resilience measures and strategies as well as risk monitoring.

ARCH's Threats and Hazard Information System (THIS) enables end-users to access geo-referenced information about historic and real-time environmental threat indicators for historic areas. **ARCH's Historic Area Information System (HArIS)** enables end-users to access geo-referenced information about historic and current conditions of historic areas. It links both 3D geometry and material information, where possible, enabling structural resistance and simulated ageing analysis when combined with short and long term evolutions of air quality and climate data. Tool is available here: portal.savingculturalheritage.eu (last retrieved on 28/06/2022).

Scenario analyses and risk analysis can be performed via ad-hoc tools such as the **CIPCast tool** that allows assessing possible multi-hazard event scenarios for both real and simulated events. The CIPCast tool is made available as a service by http://www.eisac.it (last retrieved on 28/06/2022).

Impact Chains can be used to collaboratively model cause-effect relationships between hazards and potential impacts, as well as cascading effects. Impact Chains also allow to link potentially exposed elements, sensitivities and capacities to impacts, thus supporting the identification of measures.

The **Risk Systemicity Questionnaire (RSQ)**, developed by the European research project Smart Mature Resilience, can be used to identify and prioritise risk scenarios, where interdependencies between risks are shown to lead to networks of risks, including vicious cycles, and to review and prioritize mitigation

and adaptation actions for various scenarios of risk interdependencies. Tool is available here: https://smr-project.eu/tools/risk-systemicity-questionnaire/ (last retrieved on 28/06/2022).

The **Climate ADAPT Urban Adaptation Map** provides European communities with an overview of current and future climate hazards, the vulnerability of communities to these hazards and their adaptive capacity. Tool is available here: https://climate-adapt.eea.europa.eu/knowledge/tools/urban-adaptation (last retrieved on 28/06/2022).

The **IVAVIA methodology** provides guidance for a risk-based vulnerability assessment, helping to map, analyse and communicate the impact of climate trends and weather events on key elements of community's physical, social and economic fabric. IVAVIA provides guidance on how to prepare, gather, and structure data for a risk-based vulnerability assessment, to quantify and combine vulnerability indicators, to assess risk, and to present outcome. Tool is available here: https://resin-cities.eu/resources/ivavia/ (last retrieved on 28/06/2022).

ISO 14091 *Adaptation to climate change — Guidelines on vulnerability, impacts and risk assessment* provides guidance on assessing the risks related to the potential impacts of climate change. It describes how to understand vulnerability and how to develop and implement a sound risk assessment in the context of climate change. It can be used for assessing both present and future climate change risks. Risk assessment according to this document provides a basis for climate change adaptation planning, implementation, and monitoring and evaluation for any organisation, regardless of size, type and nature.

ISO/TS 14092 *Adaptation to climate change — Requirements and guidance on adaptation planning for local governments and communities* describes, among other things, climate change parameters, impacts and impact assessments methods for local governments and communities.

6.3 Identify risk prevention, mitigation, climate change adaptation and emergency response measures

6.3.1 General information

This subclause provides information on Step 3 of the DRM/CCA Framework.

This step aims at identifying suitable risk prevention, mitigation, climate change adaptation and emergency response measures as well as strategies to lower the risk and increase the resilience of the community and historic area.

NOTE   Prevention, mitigation, climate change adaptation and emergency response measures are subsequently referred to only as resilience measures.

It is based on the outputs from the vulnerability and risk assessment from the previous step, as well as information from Step 1 (see Figure 2) and additional sources.

The purpose of this step is to build a portfolio of potentially suitable measures to address risks and vulnerabilities, to identify plans and policies that may support the resilience needs, and to identify selection and assessment criteria to be used in Step 4.

6.3.2 Requirements

This subclause provides requirements that have to be fulfilled to perform Step 3 *Identify risk prevention, mitigation, climate change adaptation and emergency response resilience measures* of the DRM/CCA Framework.

–   The resilience team shall **review and analyse the results from** the hazards, exposure, vulnerability, risk and impact assessment done in **Step 2,** including cascading effects within the city's systems or on the historic area management. The resilience team develops its own methodology or adopts established methods to analyse impact chains and cascading effects.

– When reviewing the results of Step 2 and identifying potential resilience measures, the resilience team shall **bring together a multi-disciplinary group of stakeholders to identify potentially suitable measures**, including local residents and building owners, non-government organisations, academic institutions, cultural associations, and local businesses, but also representatives from disproportionately affected stakeholder groups.

– The resilience team shall **define criteria for the ranking and selection of resilience measures** to be used for the assessment of the identified measures in Step 4. These criteria may include: Environmental effectiveness, benefit-cost analysis, potential co-benefits, acceptability, awareness improvement, urgency of action, long-term effect on the historic area (including enhancing the significance of historic areas), compatibility with heritage management practices, and long-lasting effects on the local communities (including the effects on its most vulnerable members). Legislative texts and regulations on the use and management of the historic area, which influence the effectiveness of the implementation of the resilience measures shall be considered, e.g. monument preservation regulations.

– When identifying potential resilience measures as well as supporting policies and processes, the resilience team shall **take note of local, traditional practices and knowledge**. The resilience measures shall not only be aimed at physical measures, but also target mainstreaming resilience thinking into different governance processes and policies.

– When identifying potential resilience measures, the resilience team shall try to (initially) **identify suitable funding opportunities and financing measures**, including using public-private-partnerships.

6.3.3 Recommendations

This subclause provides recommendations on how to fulfil Step 3 *Identify risk prevention, mitigation, climate change adaptation and emergency response resilience measures* of the DRM/CCA Framework.

– Potential resilience **measures should be identified using existing databases** (for climate resilience research and/or practice).

– **Additional information for potentially suitable measures should be collected** to inform the selection process. This can for example include information about implementation restrictions, cost estimates, relevant standards and policies. Information should be gathered from existing guidance material and other relevant example projects, consultations with experts, but also information from historical knowledge and local communities.

– The identified **measures should be described in an understandable and systematic** way to facilitate assessment and selection in the next step.

– Increased awareness about all, or most, potential options is an important part of risk mitigation. Therefore**,** providing **information to citizens about risks, but also about identified potential climate change adaptation, prevention and emergency response measures**, should be perceived as an important part of risk mitigation.

6.3.4 Supporting materials and tools

This subclause provides a selection of supporting tools and materials useful for the Step 3 of the DRM/CCA Framework.

Building Information Models (BIM) and heritage inventories can provide additional information for the selection of measures by providing information on the condition of the historic area and (material) restrictions for the application of resilience measures.

The **Climate-ADAPT platform** of the European Environment Agency can be used as an initial source for case studies, policies, and other supporting materials. Tool is available here: https://climate-adapt.eea.europa.eu/ (last retrieved on 28/06/2022).

The **RESIN Adaptation Options Library** is a searchable database of all kinds of adaptation measures, addressing climate risks including heat; pluvial, fluvial and coastal floods; and drought. The performance of these measures has been evaluated through an extensive review of scientific literature, with references corresponding to each measure indicated as relevant. There are two entry points to the Library: a 'quick access' entry point for a basic review of available measures, and another for a more detailed investigation. Tool is available here: https://resin-cities.eu/resources/library/ (last retrieved on 28/06/2022).

The **ARCH Decision Support System (DSS)** is a web-based platform, which enables end-users to gain awareness and knowledge on the possible impacts that natural hazards might induce on the different dimensions of historic areas and on the effectiveness that resilience strategies might have on reducing such impacts. It uses the information provided by the ARCH HArIS and ARCH THIS for vulnerability and risk assessments under different scenarios (historic and artificial). Depending on the available data as well as the scope and resolution of the assessment, it supports quantitative as well as qualitative assessments on building, area, and territorial scale. The ARCH DSS supports the identification and assessment of resilience measures and strategies as well as risk monitoring.

The **ARCH Resilience Assessment Dashboard** (ARCH RAD) is a web-based tool to assess how well the DRM/CCA Framework is implemented. The ARCH RAD will enable end-users to perform resilience self-assessments for historic areas, in long-form or quick versions. Tool is available here: rad.savingculturalheritage.eu (last retrieved on 28/06/2022).

The **ARCH Resilience Measures Inventory** and **SHELTER Solution Portfolio** provide databases of resilience measures with additional information, including cost-effectiveness assessments, co-benefits, implementation restrictions, and more. Tool is available here: rmi.savingculturalheritage.eu (last retrieved on 28/06/2022).

ISO 14090 *Adaptation to climate change — Principles, requirements and guidelines* specifies principles, requirements and guidelines for adaptation to climate change. This includes a subclause on the identification of climate change adaptation actions. This document is applicable to any organisation, regardless of size, type and nature, e.g. local, regional, and international, business units, conglomerates, industrial sectors, natural resource management units.

6.4 Assess and select resilience measures and procedures

6.4.1 General information

This subclause provides information on Step 4 of the DRM/CCA Framework.

In this step a prioritisation of the identified resilience (prevention, mitigation, climate change adaptation and emergency response) measures is conducted by determining their performance with regard to enhancing resilience and safeguarding the community and historic area in a socially just way.

6.4.2 Requirements

This subclause provides requirements that have to be fulfilled to perform Step 4 *Assess and select resilience measures and procedures* of the DRM/CCA Framework.

– All potentially suitable **resilience** (prevention, mitigation, climate change adaptation and emergency response) **measures shall be assessed** based on the selected criteria from Step 3.

– The identified resilience (prevention, mitigation, climate change adaptation and emergency response) **measures shall be classified and prioritised**, according to the individual community case and emergency phase. In addition, the resilience measures shall be ranked by topic (cost, speed, time to implement etc.) and through a Multi-Criteria Analysis.

– The selection process shall **include those parties involved in the implementation of the measures** and particularly local communities and other stakeholders affected by the measures or in a particularly vulnerable position.

– Barriers to measures, such as **financial issues, existing policy limitations and/or acceptance of stakeholders shall be considered** and assessed.

6.4.3 Recommendations

This subclause provides recommendations on how to fulfil Step 4 *Assess and select resilience measures and procedures* of the DRM/CCA Framework.

– When selecting resilience measures to be implemented, the resilience team should **dedicate significant attention to informing citizens and business owners located or operating in the affected area or around it**. They should be informed and receive training in order to be ready to act and maintain the essential services of the community and the historic area.

– **Resources for implementation**, as well as associated effects on the social-ecological system **should be considered when selecting measures**.

– The resilience team should **organise open consultation meetings and workshops** with relevant stakeholders for the development and internal evaluation of the resilience measures prior to their release, and for awareness-raising.

– The resilience team should also **engage with the general public to get feedback** on their work and activities and conduct workshops to identify user-oriented approaches for the selection of measures.

– The resilience team should **consider the whole social-ecological system to weight impacts and trade-offs** with an eye toward the overreaching goal.

6.4.4 Supporting materials and tools

This subclause provides a selection of supporting tools and materials useful for Step 4 of the DRM/CCA Framework.

The **City Resilience Dynamics Tool (CRD)** can be used to test and validate the relationships between the different policies that could, potentially, be included in the resilience strategy of a city, and the impact of those policies in building local resilience. The CRD supports city disaster managers in diagnosing, exploring and learning about the resilience-building process by running simulations of the effects of implementing certain policies over a realistic time frame (yearly to a total of 40 years). Tool is available here: https://crd.smr-project.eu/ (last retrieved on 28/06/2022).

The **NATURVATION Urban Nature Navigator** can be used to identify tools and models to assess different nature-based solutions based on the urban sustainability challenges faced. Tool is available here: https://naturvation-navigator.com/ (last retrieved on 28/06/2022).

The **ARCH Inventory of Funding Opportunities** identifies public and private funding options, favouring sustainable and ethical financial solutions, in order to define and implement best practices for financing

the implementation of resilience plans. New financing forms, like crowdfunding or climate bonds, are also evaluated for their suitability. The ARCH Deliverable 6.3 "*Inventory & Characterization Report of funding measures*" is available here: https://savingculturalheritage.eu/resources/deliverables (last retrieved on 28/06/2022).

6.5 Implement selected measures

6.5.1 General information

This subclause provides information on Step 5 of the DRM/CCA Framework.

In this subclause the selected measures and procedures from Step 4 are integrated into a resilience action plan and implemented. This also includes establishing (and practicing) relevant emergency response procedures, as well as preparing potential recovery and reconstruction measures.

6.5.2 Requirements

This subclause provides requirements on how to fulfil Step 5 *Implement selected measures* of the DRM/CCA Framework.

– A **resilience action plan shall be developed (including resilience goals) and put into motion** based on the outcomes identified in Step 1 to 4 as the assessment context provides the basis for setting priorities and goals for the co-creation of the plan. The resilience action plan shall align selected resilience measures and activities with specific risks and/or resilience weak points and include responsible parties for implementing each measure as well as an tentative timeline for implementation; in addition, a prioritisation of the activities within the plan shall be included, taking into account, for instance, the special needs of vulnerable groups identified and mapped during Step 2.

– **Responsibilities and available resources are to be allocated for each activity in the resilience action plan**. The resilience team shall revise the resilience action plan, based on available resources during implementation (see also Step 6).

– The selected resilience **measures and processes shall be openly communicated to the community** and stakeholders affected. Therefore, different channels shall be used, as the diversity of stakeholders is high.

EXAMPLE   Stakeholder workshops, leaflets, school visits, social media, websites, festivals, campaigns, podcasts, webinars/online seminars, ad-hoc meetings, focus groups.

– The resilience action plan shall **link to existing emergency response plans** (see Step 7). In the case that there is no emergency response plan in place, **emergency response measures shall be set up**, including regular drills with relevant authorities and other organisations as well as communities and businesses.

6.5.3 Recommendations

This subclause provides recommendations on how to fulfil Step 5 *Implement selected measures* of the DRM/CCA Framework.

– If possible, **community groups** (especially nearby the historic area), businesses, NGOs, the responsible units for the historic area, regulators on national, European and international level (e.g. UNESCO) and emergency response teams from neighbouring cities **should be involved in the implementation of resilience measures.** A continuous communication process (a two-way communication with feedback loops) with such stakeholders should be established to evaluate impacts and effects of the resilience-building process in their normal, everyday operations.

– The resilience team should **establish subgroups to carry out actions to support the implementation of the resilience measures**, preferably with staff from different departments and with the involvement of relevant stakeholders and partners.

– For some solutions (like nature-based solutions or blue-green infrastructure etc.), **establishing a collaborative governance model and long-term maintenance funding** is likely to be beneficial.

– **Interoperability of emergency response systems** with neighbouring cities and other authorities should be sought.

6.5.4 Supporting materials and tools

This subclause provides a selection of supporting tools and materials useful for Step 5 of the DRM/CCA Framework.

The **ARCH Resilience Measures Inventory** provides a databases of resilience measures with additional information, including cost-effectiveness assessments, co-benefits, implementation restrictions, and more. Tool is available here: rmi.savingculturalheritage.eu (last retrieved on 28/06/2022).

The **Resilience Pathway Visualisation Tool (RPVT)** allows to visually construct implementation pathways for resilience measures, i.e. which resilience measures have to be implemented in which sequence to raise the resilience to a certain level until a certain time. It also allows to assess alternative resilience pathways. Tool is available here: http://arch.tecnalia.com/index (last retrieved on 20/09/2022).

ISO 22396 *Security and resilience — Community resilience — Guidelines for information exchange between organisations* describes principles, a framework and a process for information exchange. This document is applicable to private and public organisations that require guidance on establishing the conditions to support information exchange. This document does not apply to technical aspects but focuses on methodology issues. The information can be beneficial for the creation of the communication process.

ISO 14090 *Adaptation to climate change — Principles, requirements and guidelines* provides, among other things, requirements and recommendations on the content of an adaptation plan. This includes information on the scope, implementation, monitoring and evaluation of the adaptation plan. The information can be beneficial for the formulation of the resilience action plan.

ISO/TS 14092 *Adaptation to climate change — Requirements and guidance on adaptation planning for local governments and communities* describes, among other things, the formulation of an adaptation plan to protect peoples` lives and property for local governments and communities. This includes information on the scope, boundaries, decision-making and documentation. The information can be beneficial for the formulation of the resilience action plan.

6.6 Establish resilience monitoring, evaluation and learning processes

6.6.1 General information

This subclause provides information on Step 6 of the DRM/CCA Framework.

In this step processes for monitoring/evaluation of and learning from the resilience-building process are established – if no such processes exist. If processes already exist, they might need to be checked and, if necessary, adapted. These monitoring, evaluation, and learning processes should aim not only to monitor the progress in implementing resilience measures ("are we doing the right things?"), but also to monitor the resilience-building process ("are we doing the things right?") to evaluate whether it is working as intended and to establish a continuous learning loop for improving the resilience-building process and the implemented activities.

As mentioned earlier, Steps 1 to 6 should be repeated and updated on a regular basis to ensure that up-to-date information and data is fed into the process and plans, and procedures are updated to reflect changing needs. Without a regular process, no long-term resilience can be achieved.

In addition to monitoring the resilience-building process and the progress in implementing resilience measures, Step 6 also includes monitoring potential disasters (using already existing early warning systems or early warning systems that might have been set-up as part of Step 5). Once a warning of an imminent disaster is given, Step 6 is used to activate the emergency response measures (as prepared in Step 5), which are executed in Step 7.

In case a disaster occurs earlier than the end of Step 6, the regular process is interrupted, and Steps 7 to 8 become active.

6.6.2 Requirements

This subclause provides requirements on how to fulfil Step 6 *Establish resilience monitoring, evaluation and learning processes* of the DRM/CCA Framework.

– **The resilience team shall establish and execute monitoring, evaluation and learning processes** together with other relevant stakeholders (also from regional and national level). These processes shall take into account the baseline assessment (see Step 1) and include the monitoring of the implementation and impact of actions and activities from the resilience action plan. These processes shall also include monitoring the goals and objectives (see Step 1) of the resilience action plan. The monitoring processes, including monitoring responsibilities and roles, are defined in the resilience action plan so that it is clear what monitoring means for each community and its historic areas.

– The **resilience team shall check already existing relevant monitoring, evaluation and learning processes**, in literature, but also within community and historic area archives to re-use them, whenever they are suitable, in order to minimise costs.

– The **resilience team should engage previously identified or new relevant stakeholders** in the resilience monitoring, evaluation and learning processes.

– A **continuous monitoring process for exposures, vulnerabilities, risks and impacts from climate change-related and natural hazards shall be established.** This includes monitoring the indicators used for the risk assessment as well as the indicators used to represent the estimated impacts. As for the risk assessment, the indicators to monitor include: hazard indicators (including non-climatic drivers that might exacerbate hazards such as population growth and urban development), exposure indicators, vulnerability indicators for both the physical, social and economic dimension of historic areas.

– **Output-oriented indicators for monitoring the implementation process** of resilience measures considered in the monitoring, evaluation and learning plan **shall be established**.

– **Outcome and process-oriented indicators for monitoring the progress of the DRM/CCA Framework shall be established** to facilitate monitoring and learning processes. These shall include developing a theory of change to establish specific resilience-building objectives, linked to certain measures, and additional assumptions in order to come up with a coherent formulation against which an evaluation can be made.

– **A detailed resilience evaluation shall be conducted** in order to assess how well the DRM/CCA Framework has been implemented so far.

6.6.3 Recommendations

This subclause provides recommendations on how to fulfil Step 6 *Establish resilience monitoring, evaluation and learning processes* of the DRM/CCA Framework.

– The **identification of the systems and tools that will be necessary to assess the resilience action plan's goals** should take place to adapt and use, whenever possible, already existing systems and tools for monitoring.

– A **continuous communication mechanism should be established** to continuously inform all relevant stakeholders, including decision-makers, but also local communities and other actors connected to the resilience-building process. Engaging stakeholders to determine which information channels are most appropriate will facilitate communication.

– The **communication mechanism should seek to use the potential of historic areas** and arts and culture to move citizens to action when faced with climate hazards and disasters in their community.

– The communication of the DRM/CCA Framework and its achievements can take the form of **a public dashboard to report on the progress of the resilience action plan** and the indicators and raise awareness.

6.6.4 Supporting materials and tools

This subclause provides a selection of supporting tools and materials useful for Step 6 of the DRM/CCA Framework.

The **Copernicus EMS (Emergency Management Service) Early Warning and Monitoring Services** provide continuous observations and forecasts with regards to floods, droughts and forest fires. Tool is available here: https://emergency.copernicus.eu/ (last retrieved on 28/06/2022).

The resilience team can use the **Resilience Building Policies tool (RBP).** This tool helps to detail case studies as part of reporting. The RBP can be used to share the results of the evaluation with politicians, stakeholders and citizens, as well as with other cities. Tool is available here: https://smr-project.eu/tools/resilience-building-policies/ (last retrieved on 28/06/2022).

ISO 37123 *Sustainable cities and communities – Indicators for resilient cities* provides definitions and methodologies for a set of indicators on city resilience. This document is applicable to any city, municipality or local government that undertakes to measure its performance in a comparable and verifiable manner, irrespective of size or location. Maintaining, enhancing and accelerating progress towards improved city services and quality of life is fundamental to the definition of a resilient city. This document is intended to be implemented in conjunction with **ISO 37120** *Sustainable cities and communities – Indicators for city services and quality of life*.

The **SilK tool** is a knowledge base for protection and conservation of cultural properties. The tool helps to evaluate the protection efforts of cultural properties, and offers tips and possible solutions. Tool is available here: https://www.silk-tool.de/en/ (last retrieved on 28/06/2022).

NOTE   Documents and links referred to are in most cases only available in German.

The following tools from the previous steps are also useful in this step:

– ARCH Resilience Assessment Dashboard (ARCH RAD),

– ARCH Resilience Measures Inventory (RMI),

– Resilience Pathway Visualisation Tool (RPVT),

– ARCH Threats and Hazard Information System (THIS),

– ARCH Historic Area Information System (HArIS).

7 During disaster – Emergency operating phase

7.1 Conduct emergency response procedures

7.1.1 General information

This subclause provides information on Step 7 of the DRM/CCA Framework.

This subclause refers to actual emergency response procedures that need to be defined to safeguard humans and relevant heritage assets. These emergency response procedures start from the moment that a disaster takes place, assign responsibility to authorities and community groups for carrying out specific actions at projected times and places in an emergency that exceeds the capability or routine responsibility of any one agency, and sets an example on how all actions shall be coordinated.

7.1.2 Requirements

This subclause provides requirements on how to fulfil Step 7 *Conduct emergency response procedures* of the DRM/CCA Framework.

– **Emergency response plans shall be executed** in this step, while humans, infrastructures, buildings, and ecosystems need to be secured. The emergency response plan shall link to the resilience action plan (see Step 5). As part of the emergency response plan, theft of collapsed or damaged fragments needs to be prevented.

– **Emergency assistance to vulnerable groups shall be prioritised and the essential services of the community need to be kept running**. For this reason, a variety of stakeholders shall be identified and engaged – these stakeholders shall be invited to trainings to make sure that they understand the essential functions and procedures of this step and are able to respond adequately during the emergency operating phase.

7.1.3 Recommendations

This subclause provides recommendations on how to fulfil Step 7 *Conduct emergency response procedures* of the DRM/CCA Framework.

– Utilities and **critical infrastructure providers should be informed and ready to act**. The resilience team should establish a communication protocol for these providers to make sure that all receive coherent and accurate information and engage in the emergency response plan in a timely manner.

– **Effective communication between first responders and disaster response teams should be ensured**. The resilience team should become a facilitator and connector between first responders and the disaster response teams. While first responders will generally include immediate emergency services, like firefighters, police, or medical services, disaster response teams might include specialized services, like governmental disaster relieve organisations, civil protection agencies, NGOs, and (local) volunteers.

– Every resilience team should at least **designate one person responsible for the salvage plan** for movable heritage items and for securing unmovable cultural heritage building. A salvage plan is a

document that identifies objects that need to be removed (highlighting specific items that should be removed first due to their peculiar historical value or social value for the local population) and how this should be done.

7.1.4 Supporting materials and tools

This subclause provides a selection of supporting tools and materials useful for Step 7 of the DRM/CCA Framework.

The **Copernicus EMS (Emergency Management Service) on Demand Mapping** provides on-demand detailed information for selected emergency situations that arise from natural or man-made disasters anywhere in the world. Tool is available here: https://emergency.copernicus.eu/ (last retrieved on 28/06/2022).

The **Resilience Building Policies tool (RBP),** already mentioned in Step 6, offers a collection of case studies as a reference for cities for further information. The Resilience Building Policies tool shows replicable examples of successful and effective initiatives that cities have taken to build resilience locally before, during and after a disaster takes place. Tool is available here: https://smr-project.eu/tools/resilience-building-policies/ (last retrieved on 28/06/2022).

Standards from ISO/TC 292 on Security and Resilience can be used for emergency management, e.g.:

– **ISO 22320** *Security and resilience – Emergency management – Guidelines for incident management* provides information on principles that communicate the value and explain the purpose of incident management. The document also describes basic components of incident management, including process and structure, which focus on roles and responsibilities, tasks and management of resources, and working together through joint direction and cooperation. This document is applicable to any organisation involved in responding to incidents of any type and scale.

– **ISO 22322** *Societal security – Emergency management – Guidelines for public warning* provides guidelines for developing, managing, and implementing public warning before, during, and after incidents. This International Standard is applicable to any organisation responsible for public warning. It is applicable at all levels, from local up to international. Before planning and implementing the public warning system, risks and consequences of potential hazards are assessed. This process is not part of this International Standard.

– **ISO 22329** *Security and resilience – Emergency management – Guidelines for the use of social media, in emergencies* gives guidance on the use of social media in emergency management. It gives guidance on how organisations and the public can use, and interact through, social media before, during and after an incident as well as how social media can support the work of emergency services. This document is applicable to governmental and non-governmental organisations involved in emergency management and crisis communication.

– **ISO 22319** *Security and resilience – Community resilience – Guidelines for planning the involvement of spontaneous volunteers (SV)* intends to help organisations to establish a plan to consider whether, how and when SVs can provide relief to a coordinated response and recovery for all identified hazards. It helps identify issues to ensure the plan is risk-based and can be shown to prioritize the safety of SVs, the public they seek to assist and incident response staff. This document is intended for use by organisations with responsibility for, or involvement in, part or all of the planning for working with SVs.

– **ISO 22395** *Security and resilience – Community resilience – Guidelines for supporting vulnerable persons in an emergency* gives guidance to organisations to identify, involve, communicate with and

support individuals who are the most vulnerable to natural and human-induced (both intentional and unintentional) emergencies. It also includes guidelines for continually improving the provision of support to vulnerable persons in an emergency. It is intended for use by organisations with the responsibility for, or involvement in, part or all of the planning for working with vulnerable persons in an emergency.

8 Post-disaster – Emergency operating phase

8.1 Assess needs and impacts

8.1.1 General information

This subclause provides information on Step 8 of the DRM/CCA Framework.

After the initial phase of the disaster is over and emergency procedures have been conducted, damages, impacts, and needs, within and surrounding the historic area, have to be assessed. The results from the damage and needs assessment should ideally inform a subsequent update of the risk assessment before the reconstruction phase in order to inform decision making and support future risk reduction and building back better.

8.1.2 Requirements

This subclause provides recommendations on how to fulfil Step 8 *Assess needs and impacts* of the DRM/CCA Framework.

– **Differentiated assessments shall be conducted**, including damages to tangible and intangible historic areas, as well as historical housing stock, damages to and needs of creative and cultural industries, needs of the population, with specific focus on minorities and population groups disproportionately affected by disasters. This also includes damage and needs assessments with specific focus on climate change adaptation and environmental issues in order to avoid that stabilizing and reconstruction measures at a later point worsen the environmental situation.

– Relevant **data and information** (e.g. from rapid risk assessments) **shall be systematically collected** to inform the following steps. This data and information shall be checked on a rotating and ongoing basis, to make sure that there are no inconsistencies.

8.1.3 Recommendations

This subclause provides recommendations on how to fulfil Step 8 *Assess needs and impacts* of the DRM/CCA Framework.

– The **resilience team should develop an inventory of damages**, making use of current observations, previous knowledge and databases.

– The **resilience team should moderate between public authorities and local communities** (e.g. decide on what can be restored and what should be classified as total losses).

8.1.4 Supporting materials and tools

This subclause provides a selection of supporting tools and materials useful for Step 8 of the DRM/CCA Framework.

Rapid mapping services to ensure provision of geospatial information after the occurrence of a disaster can be used, e.g. from Copernicus. The Copernicus Rapid Mapping tool is available on the following website: https://emergency.copernicus.eu/mapping/ems/rapid-mapping-portfolio (last retrieved on 28/06/2022).

8.2 Stabilise situation

8.2.1 General information

This subclause provides information on Step 9 of the DRM/CCA Framework.

In this subclause, the most urgent stabilising measures are performed to enable the following recovery and building back better procedures.

8.2.2 Requirements

This subclause provides requirements on how to fulfil Step 9 *Stabilise situation* of the DRM/CCA Framework.

– The **resilience team shall coordinate and communicate with relevant stakeholders** involved in implementing stabilising measures, including local, national, and international volunteers, community groups, and NGOs, as well as actors from the emergency response, planning and development sectors. This can include organising workshops or holding regular meetings.

– **Headquarters or a communication hub shall be established as a single-point-of contact for information** about the stabilising effort. Information about the location, purpose and operational procedures of this headquarter (or communication hub) shall be made available to the population, visitors, and other relevant stakeholders before, during, and after the disaster.

– **Stabilising measures shall be prioritised based on the post-disaster needs assessment** carried out in previous steps, particularly Step 8. The prioritisation shall take into account human health, living conditions of residents, and the safety of the population before buildings and immaterial objects.

  1) The **stabilising measures shall be kept updated in accordance with relevant local, national, and international guidelines, regulations, and decrees** (e.g. on the safe storage of movable heritage). The measures shall include, for example, the retrieval and storage of movable heritage, the stabilisation of immovable heritage, as well as the re-establishment of the functioning of sensors for monitoring the conditions of heritage assets.

  2) **Stabilising measures shall take into account the specific needs of vulnerable groups**, for example people in need of full-time access to electricity due to medical equipment requirements. These measures shall also cover other primary resource needs, like food and water.

  3) The **stabilising measures shall cover the re-creation of community spaces** to provide the population with a sense of place and belonging.

– The **resilience team shall manage and communicate with tourists, visitors and other individuals** that are visiting the historic area to help them to be informed about the impacts of the disaster, so that they do not impede the stabilisation effort and do not put themselves in danger.

– The **necessary temporary/transitional activities shall be organised to bridge the gap between immediate emergency response, stabilising the situation, and starting the rebuilding efforts**. This might include setting up temporary housing, providing locations for food banks and schools, providing temporary hospitals, mortuaries and information centres on missing relatives, as well as supporting these necessary activities according to their priority. This prioritisation should be decided together with the local communities.

– **Stabilising measures shall also include medical and mental health support** to those in need, as well as financial and insurance support to the impacted population.

– At the end of the stabilising phase, the **resilience team shall take account of the available resources** (in terms of personnel, budget, materials, equipment, etc.).

– Prioritisation of **stabilising measures for heritage assets shall also take into account budgetary constraints**.

8.2.3 Recommendations

This subclause provides recommendations on how to fulfil Step 9 *Stabilise situation* of the DRM/CCA Framework.

– The **effects that these stabilising measures might have should be assessed in detail**, including when it comes specifically to vulnerable population groups, their needs and special requirements for emergency response and disaster preparedness.

– The **local community should be involved in this step to raise the acceptance** of the measures and compliance with existing local traditions and habits.

– Actions carried out during the **stabilisation phase should balance safety considerations, the need to maintain heritage values, authenticity, and integrity**, and the needs of community groups and local population.

– The **timing for the implementation of stabilisation measures should take into consideration**, amongst others the:

  a) nature and scale of the disaster,

  b) access to the affected area,

  c) scale of the damages (see Step 8),

  d) significance of heritage assets, and the

  e) available (local) capacity.

– **Stabilising measures should be coordinated in such a way that they do not impede each other** and the following recovery process. In addition, the stabilising measures should ensure that infrastructure is safe and potentially damaged infrastructure (e.g. damaged water or gas pipes or electric cables) does not pose subsequent risks and is secured.

– The resilience team should **set up a publicly available inventory of (movable) heritage assets** – ideally before the disaster – that can be used during the emergency and stabilising phase to communicate, e.g. by informing about damage levels and priority for action.

– The resilience team should **set up a platform where relevant guidelines and indicators can be reached at any moment by everybody.** This should be linked to the inventory of heritage assets.

– The resilience team should **create (or make accessible) guidelines on how to deal with "disaster tourists"**, taking into account the requirements and needs of local authorities and communities.

– The resilience team should **make use of satellite and geo-information services for monitoring the stabilising efforts**.

– Whenever possible, **stabilising measures should be designed in such a way that they allow access to heritage assets for the population groups** (e.g. storage depots that allow access to stored movable heritage).

8.2.4 Supporting materials and tools

This subclause provides a selection of supporting tools and materials useful for the current Step of the DRM/CCA Framework.

The **Copernicus EMS (Emergency Management Service) on Demand Mapping** provides on-demand detailed information for selected emergency situations that arise from natural or man-made disasters anywhere in the world. Tool is available here: https://emergency.copernicus.eu/ (last retrieved on 28/06/2022).

8.3 Recover and building back better

8.3.1 General information

In this subclause, the final Step 10 of the DRM/CCA Framework is described, in particular the recovery and rehabilitation measures that need to be implemented, including the revision of Steps 1 to 6 to update the results of these steps based on the new situation in the community and historic area. This is also a good opportunity to include climate change adaptation actions in the rebuilding effort in order to build back better. However, all these measures need to take the needs of the local communities and – potentially – also the heritage management needs into account to ensure that the community and historic area is rebuild in alignment with local customs.

8.3.2 Requirements

This subclause provides requirements on how to fulfil Step 10 *Recover and building back better*.

– In this step, **recovery and building back better measures shall be selected and implemented**. Ideally some measures have been pre-selected in Step 3 and 4. The final selection shall be based on an updated risk assessment (informed by the damage and needs assessment) and an updated identification and assessment process.

– The **selection of rebuilding and recovery measures shall also include impact assessments**, such as what effects the recovery measures will have on climate change adaptation and mitigation.

– **Financing and funding measures shall be identified** in order to fund the recovery and rebuild process. Co-funding and crowd-funding measures are to be considered. This might include setting up accounts/services to receive and distribute funding to relevant organisations and affected people.

– As part of the identification of financing and funding measures, it shall be **assessed for which rebuilding and recovery efforts public funding will be used** and for which private funding might be (more) suitable.

– **Institutional arrangements shall be updated**, including international NGOs supporting the rebuilding effort. In case external agencies are involved in the rebuilding effort it is paramount to include the local community in this process and ensure that their wishes and needs drive the rebuilding process. Otherwise, there is a high risk that the historic area might be rebuilt in a way that is non-compliant with local custom.

–   The resilience team shall **identify potential areas which should be abandoned due to damage beyond repair or high risks in subsequent events**. At the same time, the resilience team shall reiterate the importance of heritage to developers and (international) organisations involved in the rebuilding effort to avoid demolition (instead of restoration) of heritage due to economic concerns.

–   The resilience team shall **coordinate with regional, national, and international organisations as well as local service providers** to implement new resilience strategies or changes to existing policies to prevent future damage and raise the resilience of the historic area in the long term.

–   The resilience team shall **use this step to update the baseline information gathered in Step 1** with new and up-to-date information. This also includes updates to the risk and resilience assessments, as well as the potential resilience building measures, based on post-disaster information.

8.3.3 Recommendations

This subclause provides recommendations on how to fulfil Step 10 *Recover and building back better* of the DRM/CCA Framework.

–   **Continuous communication with local communities and between all actors involved** in the rebuilding effort should be ensured. Explanatory panels and other awareness and communication materials explaining the disaster and its consequences should be brought to the community.

–   The resilience team should **identify which changes in the social, economic, cultural, political, and environmental elements of the community and historic area have occurred due to the disaster**. This includes, for example, taking into account post-disaster changes in the composition of the population mix in and around the historic area and the subsequent emergence of new local communities.

–   It may be necessary to **mediate between conflicting opinions on the value of historic areas to different local communities** amid political and identity tensions, as reconstruction can also trigger conflict when one community/authority claims their historic area and rejects that of other communities.

–   The resilience team should **be aware of traditional gender stereotypes and the differentiated** needs of all genders, minority groups, and other disproportionately affected population groups.

–   The resilience team should **make special efforts to include women, minorities, and other disproportionately affected population groups** (and their skills, knowledge, etc.) in the rebuilding effort.

–   The resilience team should **be aware that people benefiting from recovery projects have a vested interest in the continuation of these projects** and might be less inclined to criticize them or discuss problems.

–   When deciding on rebuilding activities, the resilience team should **address conflicts between heritage building methods and modern building requirements** (e.g. energy efficiency). Here, it is important to take into account criteria that are compatible with heritage and local traditions (e.g. use of local materials as a means to implement measures with lower carbon footprint).

–   Upon completion of the rebuilding and recovery efforts, the resilience team should **draw up and publish a public report**, analysing and detailing the disaster response and identifying opportunities for further improvement.

–   During the rebuilding efforts, **temporary activities** – which may have already started during the stabilising phase – shall be established or continued **to provide necessary services and relief**. This includes food banks, schools, medical services, but also cultural traditions that provide a sense of normalcy and sense of place (e.g. markets, festivities).

–   At the end of this step, the **results of Steps 1 to 6 should be updated**, specifically the following ones:

1) Step 10.1: Identifying and evaluating, if any information and characteristics of the historic area and associated people and assets changed.

2) Step 10.2: Updating the risk and vulnerability assessment based on damage and needs assessment.

3) Step 10.3: Updating risk prevention/mitigation, climate change adaptation and emergency response options.

4) Step 10.4: If considered as needed, reassessing and revising measures and procedures.

5) Step 10.5: If considered as needed, implementing selected measures and preparing updated emergency responses.

6) Step 10.6: Revising and updating monitoring, evaluation, and learning procedures, including monitoring and evaluation of rebuilding and rehabilitation processes and measures.

8.3.4 Supporting materials and tools

This subclause provides a selection of supporting tools and materials useful for Step 10.

The **CURE Framework from UNESCO and the World Bank** emphasizes that effective city reconstruction and recovery programs require that culture be mainstreamed across the damage and needs assessments, as well as in policy and strategy setting, financing, and implementation.

The **Parliamentary Protocol for Disaster Risk Reduction and Climate Change Adaptation** (UNDRR) seeks to guide parliamentary work to meet national disaster risk reduction and climate change adaptation needs. It also seeks to support the legislative branch's contributions to the implementation of the Sendai Framework and provide tools for parliaments to use in helping to strengthen resilience and adaptive capacity to climate change.

The **Copernicus EMS (Emergency Management Service) on Demand Mapping** provides on-demand detailed information for selected emergency situations that arise from natural or man-made disasters anywhere in the world. Tool is available here: https://emergency.copernicus.eu/ (last retrieved on 28/06/2022).

9   New cycle

For nearly all steps of the DRM/CCA Framework specific guidelines already exist that can (and should) be consulted to get a deeper understanding of and find best practices for these steps. In addition, several locally specific arrangements and responsibilities on different governance levels will exist that need to be taken into account when planning and conducting the different steps.

After conclusion of Step 10 – and if no additional disaster strikes – the resilience management process should resume its normal operating phase, i.e. start a new cycle at Step 1 at a regular time interval to

maintain and improve the resilience and adapt to newly occurring external events and/or changing circumstances.

Annex A
(informative)

Template to characterise historic areas

Description of the element and examples	*Characterisation of the historic area (to be filled out by end user)*
Built & natural environment	
Describe the works of human, nature, and combined works of nature and humans that belong to the historic area. These environments provide the setting in which all living and non-living things exist. They can range in scale from monuments, buildings, and parks or green spaces to neighbourhoods, cities, or even multiple regions. **These environments may include:** – archaeological prehistoric sites – tombs, caves, sacred places, temples, burial sites – streets, squares, markets, parks and gardens (both historic and contemporary) – castles, theatres, churches, cathedrals, city halls, residential buildings, businesses, shopping centres, and parking areas (also potentially historic and contemporary) – unmovable structures like frescoes, mosaics, pavements, fountains, obelisks, fortifications, and town walls – forests, trees, botanical gardens, grasslands, agricultural landscapes, mining landscapes, cultural landscapes, rivers, channels, lakes, and wetlands – animals	

Description of the element and examples	*Characterisation of the historic area (to be filled out by end user)*
Supporting infrastructures & services (physical)	
Describe the (public and private) supporting infrastructure and services that are necessary for the functioning of the historic area. **These infrastructures and services may include:** – energy and gas infrastructure – water infrastructure, including drinking water, drainage and sewage systems – transportation networks, including railways, roads, and waterways – communication infrastructure – health, education and other social infrastructure, including community centres, social housing, case and fostering infrastructure – emergency management and other public service infrastructure, like fire and police stations	

Description of the element and examples	*Characterisation of the historic area (to be filled out by end user)*
Moveable heritage	
Describe the movable heritage in the historic area. **This may include:** – pictures, paintings and drawings – manuscripts, books, documents and publications – statuary art and sculptures – archaeological materials and finds, including bones, textiles, pottery, ceramics – tables, stalls, benches, carousels – musical instruments	

Description of the element and examples	*Characterisation of the historic area (to be filled out by end user)*
Socio-cultural context (intangible heritage features)	
Describe the social and cultural elements of the historic area. These include the communities of people living and/or working in the historic area, as well as people using the historic area for recreation or touristic activities. It also includes the spiritual, material, intellectual, and emotional features of society or the relevant social groups, in addition to art and literature, lifestyles, ways of living together, value systems, traditions, and beliefs. For these elements special attention should be paid to (and ensure the meaningful inclusion of) vulnerable population groups and groups disproportionately affected by disasters, including non-native speakers, children and adolescents, the elderly, people with disabilities, immigrants, women, people with lower educational degrees, people residing in areas of high poverty, and the unemployed. **These elements may include:** – population groups, including residents, commuters and workers, tourists, volunteers – traditional groups, communities, and other community organisations, such as Indigenous people, local interest groups and associations, and friends of heritage groups – social practices, norms, and behaviours, such as social networks that facilitate cooperation, community involvement in decision making, and everyday practices – cultural and traditional practices, knowledge, and skills, including traditional craftsmanship, vernacular architecture, crafts and traditional agricultural techniques, traditional healing systems, traditional ecological wisdom, other traditional resilient behaviours, and gastronomy – rituals, events, and arts, such as festivals, religious rituals, ceremonies, theatre, music, dances, and storytelling – oral traditions and expressions, such as proverbs, poems, tales, legends, dialects, folklore, and songs	

Description of the element and examples	*Characterisation of the historic area (to be filled out by end user)*
Economic context	
Describe the (public and private) economic elements of the historic area, i.e. the elements of production, distribution, trade, as well as consumption of goods and services. **These elements may include:** – tourism – agriculture – animal husbandry – production and other services – night-time economy and entertainment	

Description of the element and examples	*Characterisation of the historic area (to be filled out by end user)*
Political context / Governance	
Describe the government elements of the historic area and its policy context, i.e. the set of codified principles and institutions that guide, compel, or prohibit actions of members of the society. **These elements may include (non-exhaustive list):** – official regulations, plans, and standards, such as spatial plans, disaster risk management plans, climate change adaptation plans, emergency plans, building codes, and conservation regulations – institutions and institutional arrangements, such as government facilities and offices, property owners, and other management facilities or authorities	

Description of the element and examples	*Characterisation of the historic area (to be filled out by end user)*
Function & use	
Describe how the historic area is used by people and which function it provides to them and its surroundings. **This may include:** – touristic use – work & housing – recreation – food – artistic & cultural use	

Risk information	
Describe the different factors that might put the historic area at risk, including the hazard(s) that the different elements of the historic area might face, which elements might be exposed to which hazards, what makes these exposed elements vulnerable to the specified hazards (including sensitivity and capacity), and which potential impacts might result from this.	
Description of the element and examples	*Characterisation of the historic area (to be filled out by end user)*
Hazard(s) **Hazards might include:** – geophysical hazards, such as earthquakes, mass movements, or volcanic activity – climate-related hazards, such as extreme precipitation, extreme temperatures, drought and water scarcity, fluvial and pluvial flooding, severe wind, sea-level rise, ocean acidification, pollution, or wildfires – biological hazards, such as viruses, bacteria, fungi, vegetal or animal action – human-induced hazards, such as land-use change or misuse, pollution, accidents, terrorism, armed conflicts, wilful damage, and cyber-attacks These hazards can cause further cascading hazards, like tsunamis, faulting, lava flows, lightning, heatwaves, changes in wet/dry cycles, salt intrusion, wave impact, pandemics, root wedging, acid rain, industrial accidents, or explosions.	
Exposed elements Exposed elements relate to the elements present in the historic area that may suffer impacts (direct and indirect) as a result from a specific (combination of) hazard(s). These will include the elements described in the previous sections of this template.	
Vulnerability Vulnerability describes the propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts including sensitivity or susceptibility to harm and lack of capacity to cope and adapt. In short: What are the factors that make the elements more or less susceptible to the impacts of specific hazards?	

Impacts Impacts are the effects the occurrence of one (or multiple) hazard(s) have on natural and human systems. Impacts generally refer to effects on lives, livelihoods, health, ecosystems, economies, societies, cultures, services, and infrastructure due to the interaction of hazardous events occurring within a specific time period and the vulnerability of an exposed society or system. **Impacts can be:** – physical (e.g. damage to buildings) – societal (e.g. injuries of humans) – functional (e.g. loss of access to or disruption of services) – economic (e.g. loss of revenue) – intangible (e.g. loss of heritage value)	

Annex B
(informative)

Indicators per step of the DRM/CCA Framework

Step 1 – Prepare the ground

–   Number of people taking part in the resilience team or office

–   Percentage of the resilience team or office dedicated to for example climate change adaptation, heritage preservation/management, disaster risk management, urban planning, financing office

–   Percentage of the relevant stakeholders with high, medium, or low engagement

–   Budget of the resilience office per year or per four years (personnel)

–   Budget for each of the resilience cycle's steps

–   Number of funding applications

–   Amount of private and government supported investment funds

–   Percentage of resilience objectives defined for the historic area based on available data

–   Number of identified knowledge gaps

Step 2 – Assess vulnerabilities and risks

–   Percentage of knowledge sources reviewed in a certain time (hazard information, data sources for carrying out a risk, vulnerability and impact assessment and methods)

–   Percentage of knowledge updated and integrated in the assessments in a certain time (hazard information, data sources for carrying out a risk, vulnerability and impact assessment and methods)

–   Number of vulnerability and risk assessment studies performed per hazard for the prioritized hazards (number of scenarios considered per study, number of historic areas considered, percentage of elements considered regarding the total number of the exposed elements for a historic area)

–   Number of impact assessment studies performed per hazard for the prioritized hazards (number of scenarios considered per study, number of historic areas considered, percentage of economic impact assessment regarding total number of performed impact assessments)

–   Number of [impacts, vulnerability, and risk] assessments considering cascading effects

–   Percentage of resilience objectives defined after the assessment of vulnerabilities of the exposed elements and risk

Step 3 – Identify resilience measures

–   Number of sources used to identify resilience measures

- Number and type of identified measures per hazard addressed in the vulnerability and risk assessments (number and type of identified measures per hazard specifically addressing prevention, mitigation, adaptation, and emergency response processes of each historic area, number of identified measures that may be qualified as best practices for resilience of historic areas)

- Number and type of stakeholder groups involved in the process of identifying resilience measures (over time)

- Number of workshops organised per year with relevant stakeholders for the historic area and the community, engaged in prevention, mitigation, adaptation and emergency response processes to identify/complement the resilience measure portfolio

- Number and type of stakeholder groups involved in the process of identifying and selecting the relevant criteria to assess and benchmark resilience measures

- Number of workshops organised per year with relevant stakeholders for the historic area and the community, engaged in the identification and selection of the relevant criteria to assess and benchmark resilience measures

- Number of suitable funding opportunities and financing measures identified per resilience measures included in the portfolio (over time)

- Number of sources use with data related to each identified criterion

Step 4 – Assess and select resilience measures

- Percentage of criteria to assess and select resilience measures are related to economic efficiency, environmental effectiveness, and social and governance/institutional performance

- Percentage of data used to assess resilience measures is considered to be low, medium or very robust

- Percentage of data missing to assess the resilience measures per criterion

- Percentage of data to assess the resilience measures is data driven vs. expert driven vs. co-creation driven

- Number and type of selected measures per hazard addressed in the vulnerability and risk assessments at city level (number and type of selected measures per hazard specifically addressing prevention, mitigation, adaptation, and emergency response processes of each historic area)

- Number and type of selected measures per hazard considered to be high, medium, and low priority

- Number and type of stakeholder's groups involved in the process of assessing and selecting the final list of resilience measures

- Number of workshops organised per year with relevant stakeholders for the historic area and the community, engaged in the assessing and selecting the final list of resilience measures

Step 5 – Implement selected resilience measures and prepare emergency responses

- Percentage of resilience measures with secured funding (full vs. partial)

– Resilience implementation plan's milestone status (on track, delayed, completed)

– Degree of the implementation of the resilience measures (not implemented, partially implemented, largely implemented, fully implemented)

– Percentage of resilience measures by implementation phase (not implemented, partially implemented, largely implemented, fully implemented)

– Percentage of implementation measures which have been delayed (e.g. by hazard, type of resilience measure (social, institutional, structural) etc.)

– Percentage of resilience measures fully characterised in the implementation plan (characterised by: Name and description of the resilience measure, hazard, responsible departments and leading department, planning framework (if different from a resilience planning, e.g. sustainability plan, air quality plan, climate adaptation plan, disaster management plan etc.), priority, expected implementation timeframe, cost, vulnerable population on which it has an impact (if applicable), degree of implementation, monitoring indicator (either output or impact indicator))

– Number and type of stakeholder's groups and community involved in the process of resilience measure's implementation (if applicable)

Step 6 – Establish resilience monitoring, evaluation and learning processes

– Characterisation of the monitoring, evaluation and learning framework:

o Progress assessment of the resilience action plan, among other indicators:

▪ Number of indicators related to resilience process

▪ Human resources required in the monitoring and evaluation process

▪ Percentage used budget in relation to the planned budget

o Achievements of the scheduled implementation plan:

▪ Number of indicators related to the outputs of the resilience measure's implementation phase

o Achievements of the scheduled objectives:

▪ Number of impact indicators related to the resilience action plan's objectives (e.g. learning outcomes as score for knowledge about risks)

o Post-disaster monitoring:

▪ Number and typology of damage assessment performed (in comparison to total damaged heritage)

▪ Percentage of heritage included in the inventory of damages

▪ Verification that all identified stabilizing measures comply with relevant local, national, and international guidelines, regulations, and decrees every 5 years (yes, yes partially, no)

    o   Frequency of DRM/CCA Framework monitoring by monitoring indicator type

    o   Percentage of indicators coming from other resilience action plans or relevant frameworks

– Frequency of meetings to inform the decision-makers and the local communities of the progress of the resilience action plan

– Number of communication channels in use

– Percentage of the indicators revised and readjusted according to findings of the monitoring, evaluation and learning process after a full DRM/CCA cycle has been achieved

Step 7 – Conduct emergency response procedures

– Percentage of emergency responders who have received disaster response training

– Percentage of local hazard warnings by national, regional and/or local agencies annually that are received in a timely fashion by the city and its first responders

– Percentage of emergency responders in the city equipped with specialised communication technologies able to operate reliably during a disaster event (personnel)

– Percentage of critical infrastructure providers that received emergency response information in time (per event)

– Number of communication channels between first responders and disaster response team

– Degree of the implementation of the emergency assistance procedures to vulnerable groups (not implemented, partially implemented, largely implemented, fully implemented)

– Heritage Salvage plan monitoring:

    o   Percentage of heritage covered by the plan

    o   Percentage of heritage for which a responsible person is identified and procedures on how to carry out the salvage plan and prioritize the inventory of heritage are defined

Step 8 – Assess needs and impacts

– Number of residential properties that have collapsed after a natural disaster as a percentage of total residential properties in the city

– Number of residential properties flooded after a natural disaster as a percentage of total residential properties in the city

– Percentage of the city population directly affected by a natural disaster (in comparison to total population of the city)

– Number of critical infrastructures flooded after a natural disaster as a percentage of critical infrastructure in the city

– Percentage of heritage with knowledge gap on how to perform their damage assessment per hazard type for a) tangible and b) intangible heritage

– Number of communication channels in place between the resilience team and identified relevant stakeholders to coordinate decision making on urgent stabilising measures

– Number of necessary temporary/transitional activities in place to bridge the gap between immediate emergency response, stabilising the situation, and starting the rebuilding efforts

Step 9 – Stabilise situation

– Number of community organisations involved in the stabilizing phase (per CCA/DRM cycle)

– Number or percentage of adequate storing facilities as compared to needs (e.g. suitable climatic conditions, suitable access, etc.)

– Number of insured infrastructure and housing units within the city limits

– Percentage of properties with insurance coverage for high-risk hazards

– Percentage of total insured value to total value at risk within the city

– Percentage of artworks and movable heritage assets that were recovered

– Percentage of structures and infrastructures that were covered by stabilising measures

– Number or percentage of population that have been relocated long-term (longer than a few weeks)

– Percentage of essential services functioning following the disaster (also those within the historic area)

– Number of communication channels in place between the resilience team and identified relevant stakeholders to coordinate decision making on urgent stabilising measures

– Number of necessary temporary/transitional activities in place to bridge the gap between immediate emergency response, stabilising the situation, and starting the rebuilding efforts

Step 10 – Recover and building back better

– Number of institutions, community organisations, etc. involved in the rebuilding effort

– Number of participatory workshops with the local community to build a shared vision of the building back better of the historic area

– Percentage of population engaged in volunteering activities

– Number of different communication channels used to involve/inform relevant stakeholder groups

– Frequency of updates/revisions to the recovery and rebuilding strategies and plans

– Number and type of the building back better measures selected and their prioritization (high, medium, and low priority)

– Number and type of stakeholder's groups involved in the process of assessing and selecting the final list of the building back better measures

– Percentage of housing stock, infrastructure, and other built environment that are targeted with retrofitting/resilience building measures

– Percentage of areas that needed to be abandoned due to irreparable damages

– Duration of the recovery and rebuilding efforts in days (projection)

– Duration of displacement and spatial distribution of displaced population

– Percentage of original inhabitants that return after the rebuilding effort

– Update of the baseline assessment of the historic area(s) (not started, partially completed, fully completed)

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