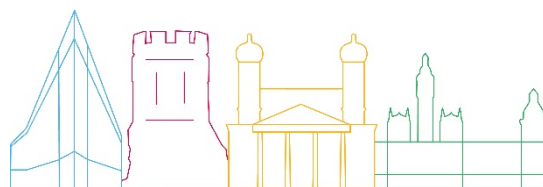




ARCH D7.6

System design, realisation, and integration



Deliverable No.	D7.6
Work Package	WP7
Dissemination Level	PU
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Due date	2022-08-31
Actual submission date	2022-08-29
Status	Final
Revision	1.0

Reviewed by (if applicable) Luca Arbau, Sonia Giovinazzi

This document has been prepared in the framework of the European project ARCH – Advancing Resilience of historic areas against Climate-related and other Hazards. This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement no. 820999.

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This project has received funding from the European Union’s Horizon 2020 research and innovation programme under Grant Agreement no. 820999.

Executive Summary

This deliverable has been prepared for the European Commission-funded research project *ARCH: Advancing Resilience of historic areas against Climate-related and other Hazards*. It reports on the key outputs of task 7.6 ‘*System realisation*’ and 7.7 ‘*Continuous system integration and validation*’ within work package (WP) 7 ‘*Framework & Integration*’ by describing the technical and methodical development process, and the final resulting tools – the ARCH HUB and the ARCH Resilience Assessment Dashboard (RAD). The two tools constitute the ‘*ARCH management platform*’ (also called ‘*ARCH data and information platform*’) as described in ARCH’s Description of the Action.

The ARCH HUB is an open access platform providing information, knowledge, and resources about resilience building for historic areas. Users can find information on how to apply the ARCH Resilience Framework (see D7.3 [1]); best practices in resilience building (see D7.2 [4]); and get access to a directory of tools, methods, and other helpful resources for resilience building from the ARCH project and beyond. The ARCH HUB is a WordPress instance and consists of the four sections ‘About’, ‘How to build resilience’, ‘Best practices’, ‘Resource hub’. The HUB will be maintained for the foreseeable future by Fraunhofer IAIS. This includes the extension of the resource hub and the best practice directory researchers, practitioners, industry professionals, as well as other projects and initiatives are welcome to contact the Fraunhofer team for including their best practice or resilience building resource into the HUB free of charge.

The ARCH RAD is a tool for self-assessing the resilience of historic areas. Typical users are decision makers relevant for historic areas – e.g., active in heritage management, disaster risk management, climate change adaptation, sustainable urban development, and resilience. The tool enables the collaborative evaluation and monitoring of the resilience maturity level of a historic area (according to the ARCH Resilience Framework described in D7.3 [1]). Users are enabled to identify resilience weak spots and receive support for the formulation of resilience action plans. The RAD consists of 221 questions, covering ten resilience topics in its detailed form, but also provides a way to reduce the number of questions, if a less detailed, quicker assessment is needed. The development of the RAD consisted of several parts – the development and formulation of the questionnaire (the core of the RAD); the design and development of functionalities, the user experience/interface design and realisation in a web application; and the technical integration with other tools from ARCH, specifically the Resilience Measures Inventory. In addition, a detailed step-by-step guide on how to use the RAD was produced. As with the HUB, Fraunhofer will maintain the RAD for the foreseeable future, with access to the tool remaining free of charge. In future, the tool might be extended or adapted to cover other urban or rural areas (e.g., smart cities) or other topics (e.g., sustainability).

This deliverable describes the development process of the HUB and RAD, gives an overview of the resulting tools, how the results of other ARCH WPs are integrated within the ARCH HUB and ARCH RAD. The deliverable also contains the RAD user manual as an annex

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List of Abbreviations

Abbreviation	Meaning
CCA	Climate Change Adaptation
CEN	European Committee for Standardization
CURE	Culture in city Reconstruction and recovery framework
CWA	CEN Workshop Agreement
DoA	Description of the Action
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
DSS	Decision Support System
FAQ	Frequently Ask Questions
HAris	Historic Area Information Management System
HYPERION	Development of a Decision Support System for Improved Resilience & Sustainable Reconstruction of historic areas to cope with Climate Change & Extreme Events based on Novel Sensors and Modelling Tools
IRP	International Recovery Platform
RAD	Resilience Assessment Dashboard
RMI	Resilience Measure Inventory
RPVT	Resilience Pathway Visualisation Tool
SES	Social-Ecological System
SHELTER	Sustainable Historic Environments hoListic reconstruction through Technological Enhancement and community based Resilience
THIS	Threats and Hazard Information Management System
UNDRR	United Nations office for Disaster Risk Reduction
UNESCO	United Nations Educational, Scientific and Cultural Organization
WP	Work Package

1. Introduction

This deliverable has been prepared for the European Commission-funded research project *ARCH: Advancing Resilience of Historic Areas against Climate-related and other Hazards*. ARCH develops decision support tools and methods to improve the resilience of historic areas to climate change-related and other hazards. These tools and methods are developed with the pilot cities of Bratislava (Slovakia), Camerino (Italy), Hamburg (Germany), and València (Spain) in a co-creative approach, including local policymakers, practitioners, and community members. The resulting solutions are bundled in a resilience knowledge base that supports guided resilience building (the ARCH HUB), and include

- an information management system for geo-referenced properties of historic areas (HArIS);
- an information management system for geo-referenced data regarding hazards, risks and impact indicators (THIS);
- a Decision Support System (DSS) for risk and impact analysis of historic areas;
- an inventory of resilience building measures linked to appropriate financing sources (RMI);
- a visual planning tool for resilience pathways (RPVT) that allows to select, prioritize and sequence potential resilience measures over time; and
- a resilience assessment dashboard (RAD) to evaluate and monitor the resilience maturity of a historic area, identify resilience weak points, and formulate resilience action plans.

This report (D7.6) is the key output of tasks 7.6 ‘*System realisation*’ and 7.7 ‘*Continuous system integration and validation*’. It describes the technical / methodological background, the development process, and the final resulting tools – the ARCH HUB and ARCH RAD, which collectively constitute the ‘*ARCH management platform*’ (also called ‘*ARCH data and information platform*’) described in the Description of the Action (DoA). In addition, it describes how the results of other work packages (WPs) are integrated within the ARCH HUB and ARCH RAD.

The co-development of the HUB and RAD has followed a flexible approach, in line with the ARCH co-creation principles (see D3.1 [2]), to account for changing needs of city partners as well as necessary development adjustments due to the COVID-19 pandemic. The split of the ‘*ARCH management platform*’ into the HUB and RAD is a result of these processes. It became clear that a single integrated system containing all the solutions offered by the different work packages of ARCH – as originally envisaged in the Description of Action – would be too complex, hindering easy comprehension by end-users and integration with existing local processes as well as existing legacy systems in the pilot cities. In addition, a deep integration of the different solutions would make exploitation of individual elements of the ARCH solution landscape more difficult (see also D7.5 [3]). Therefore, the ‘*ARCH management platform*’ was split into

- the **RAD**, which provides an online self-assessment for decision makers in heritage management, disaster risk management, climate change adaptation, sustainable urban development, and resilience at regional, municipal, and historic area level. It

enables the collaborative evaluation and monitoring the resilience maturity of a historic area according to the ARCH Resilience Framework described in D7.3 [1], allowing end-users to identify resilience weak spots, and supporting the formulation of resilience action plans;

- the **HUB**, which provides a resilience knowledge base¹ that gives end-users detailed information on i) how to apply the ARCH Resilience Framework; ii) gives access to best practices in resilience building (as provided in D7.2 [4]); and iii) provides a directory of tools, methods, handbooks, and other helpful resources for resilience building (from ARCH and beyond), linked to the steps of the ARCH Resilience Framework as well as the different topics covered by the RAD.

1.1. Relation to other deliverables

While this deliverable reports on the technical and methodological background of the HUB and RAD as well as the integration with other project outcomes, the continuous co-creation and validation process of these tools developed by technical partners in collaboration with pilot cities is described in D3.6 [5]. The results of the application of the RAD by the pilot cities are then described as part of the case study evaluation report in D3.7 [6].

The conceptual basis for the HUB and RAD is provided by the ARCH Resilience Framework, described in D7.3 [1]. In addition, the technical and methodological development of the HUB and RAD is based on the foundational work done in D7.4 '*Requirements Description*' [7], and D7.5 '*Interface specification and system architecture*' [3].

1.2. Gender statement

This document has been developed taking into consideration the guidance on gender in research provided in the Project Handbook (D1.2 [8]) as well as State-of-the-Art report number 5 of deliverable D7.1 on '*Gender aspects in conservation and regulation of historic areas, disaster risk management, emergency protocols, post-disaster response techniques, and techniques for building back better*' [9].

Following these guidelines, the Fraunhofer team tried to ensure – to the best of its capabilities – equal participation of women in all co-development activities and tried to also ensure that the voices of women and minorities received the required attention during the co-development processes. In addition, the content development for the RAD has specifically targeted the inclusion of social justice issues within the resilience building process; of the 221 questions included in the detailed assessment of the RAD, 48 questions (21.7%) deal with topics related to social justice, including gender.

¹ In the context of this deliverable (and the ARCH project) a knowledge base should be understood as a system to store structured and unstructured information (see also https://en.wikipedia.org/wiki/Knowledge_base). Specifically, the HUB is a knowledge base implemented as a Web Content Management system (see https://en.wikipedia.org/wiki/Web_content_management_system).

1.3. Structure of this report

The report is divided into five sections. Following this introductory section, [section 2](#) and [section 3](#) describe the two tools, the ARCH HUB and the ARCH RAD as well as their development process, respectively. For the ARCH HUB, first, the overall development process is described, and then each main component of the platform is described. For the ARCH RAD, first, an overview of the overall development process is provided, followed by a more detailed description of the development of the questionnaire, the technical realisation, and an overview on how the ARCH RAD works. In [section 4](#), the integration with other tools is described and in [section 5](#), a short conclusion and an outlook on how the tools will be used in the future is provided. In addition, a detailed step-by-step guide on how to use the ARCH RAD can be found in the [annex](#).

2. The ARCH HUB

The ARCH HUB provides a resilience knowledge base – i.e., a collection of information, guidance, best practices, and resources – supporting practitioners from municipal administrations, service providers, policy makers, and other local and regional actors with resilience building at the cross section of disaster risk management, climate change adaptation, heritage management, and sustainable urban development.

How to reach the ARCH HUB

<http://hub.savingculturalheritage.eu/>

The foundation of the HUB is the ARCH Resilience Framework, originally described in D7.3 [1] and extended as part of the standardisation work within task 2.6, where the framework was developed into a CEN Workshop Agreement. The HUB allows users to interactively browse through the steps of the framework, describing each step in detail and providing requirements, recommendations, as well as examples for each step.

This general guidance is accompanied by a collection of best practices for local resilience building, as originally provided in D7.2 [4], and a directory of resources, collected by ARCH partners. Both the collection and directory allow users to apply filters to ensure better usability and easier access to specific best practices and resources.

2.1. Technical basis and development process

The technical basis for the ARCH HUB is WordPress², i.e., a content management system that allows to create web pages and store static information for information provision and visualisation. The WordPress instance is hosted using Fraunhofer's central webhosting services. This allows very easy maintenance, as the technical infrastructure is maintained as part of Fraunhofer's central IT services, while maintenance of the content lies within the responsibility of the department conducting the project work³.

Original Mission of the ARCH HUB, as described in D7.4, p. 23

“The ARCH Hub will be the overall access point and integration platform of all relevant ARCH solutions and information. It will enable a collaborative management of the resilience building process and will allow the sharing of best practices by providing access to selected user groups.”

(Box 1)

² <https://wordpress.com/>

³ In case of ARCH this is the Adaptive Reflective Teams department of the Fraunhofer Institute for Intelligent Analysis and Information Systems IAIS

The development of the HUB followed the Mission-Concepts-Realisation-Implementation (MCRI) approach already described in D7.4 [7]. Within D7.4, the Mission (see Box 1) and Concepts (see Box 2) of the ARCH HUB have been described.

Original Concepts of the ARCH HUB, as described in D7.4, p. 23-24

- Integration of and access/link to ARCH developments

In order to make finding and applying the different ARCH solutions as easy as possible, a common access point is needed. The ARCH Hub will bundle all previously mentioned technical ARCH developments as well as other relevant methodologies and tools, information and data sets to give end-users a common platform for accessing them.

- Information and guidance

The ARCH solutions on their own might not necessarily be self-explanatory to all audiences. In addition, how they fit together might also not be immediately obvious. Therefore, the ARCH Hub will include information and guidance for the different ARCH tools in order to provide end-users with enough information to employ these tools themselves.

- Collaborative management

Resilience assessment and building is usually not done alone, but by a team of multiple stakeholders. Therefore, the ARCH Hub will allow teams of end-users to collaboratively assess the resilience of their historic areas and manage the resilience building process.

- Sharing of best practices

Resilience assessment is not done in a vacuum. Other end-users might have found solutions to increase the resilience of historic areas similar to a historic area under examination by another end-user. This information should be accessible in order to help end-users identify resilience measures for their historic areas. Therefore, the ARCH Hub will allow to share information about best-practices in resilience building with other end-users and user groups.

- Web-based application with different user groups

In order to give access to the largest possible group of end-users, a software system shall be platform independent and will not require installation of specific protocols or licences. Third-party systems integrated into the ARCH solutions shall have relevant licenses and access credentials embedded into services provided to end-users, such that a single login shall be sufficient to access a range of ARCH services. Therefore, the ARCH Hub will be a distributed, web-based application. It will be accessible from a variety of client devices and using different operating systems, ranging from desktop workstations and portables, to tablets and smartphones.”

(Box 2)

As can be seen, and was already explained, certain aspects of the HUB Mission changed since submission of D7.4, due to changing needs from the co-creation process (see also D3.6 [5]). Specifically, the collaborative aspect of the HUB was dropped and has subsequently been integrated in the RAD instead.

With the exception of the collaborative management aspect and the differentiation of different user groups⁴, all concepts described in the box above were implemented within the ARCH HUB. Through its resource hub (see [section 2.2](#)), the ARCH HUB provides a single access point for all ARCH tools and provides detailed information on each of them. Similarly, with the directory of best practices, the HUB provides end-users with a comprehensive overview of how to build resilience at the local level. While the detailed guidance on the ARCH Resilience Framework includes extensive information about how, if, and when to use the ARCH solutions within the resilience building process, guiding information for project external tools (e.g., from SHELTER⁵ and HYPERION⁶) is only provided to a limited degree. This is because detailed guidance for non-ARCH solutions is dependent on information provided by solution providers or local practitioners (in case of best practice examples). A complete overview of the different requirements with relevance for the HUB and which action was taken to address these can be found in D3.6 [5].

Based on the outcomes of the co-creation process, Fraunhofer iteratively developed four different sections for the ARCH HUB:

- *'About'*: A section providing general information on the HUB and links to relevant general project information, e.g., partners and pilot cities.
- *'How to build resilience'*: A section providing detailed information and guidance on the resilience building process, the different definitions used in ARCH, and the understanding of historic areas as social-ecological systems.
- *'Best practices'*: A section gathering local resilience practices that can be filtered for different aspects like disaster risk management phase, type of implemented measures, and more.
- *'Resource hub'*: A section gathering methods, tools, and other guiding documents to support different phases of resilience building that can be filtered for different aspects like the resilience building step in which they can be applied.

These sections are described in more detail below. How the structure and content of the HUB was co-developed is described in D3.6 [5].

⁴ With the switch of the HUB from a collaborative management platform to a knowledge base, a dedicated user management aspect was not necessary anymore, which is why this aspect has been dropped.

⁵ H2020 project, grant agreement no 821282, <https://shelter-project.com/>

⁶ H2020 project, grant agreement no 821054, <https://www.hyperion-project.eu/>

2.2. The sections of the ARCH HUB

When first entering the ARCH HUB, the user is directed to a simple landing page (see Figure 1), which directs users with simple explanations to the different sections of the HUB.

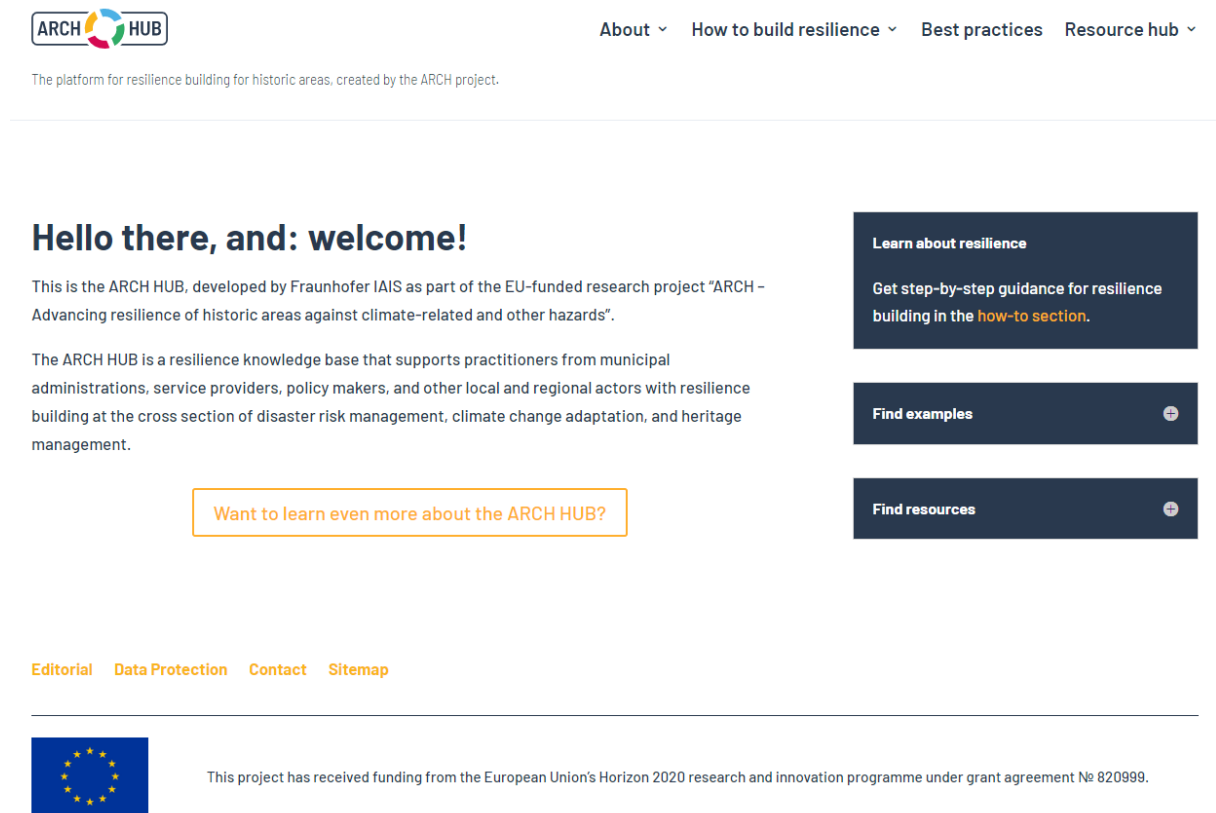


Figure 1: Landing page of the ARCH HUB

2.2.1. About

The ‘*About*’ section of the HUB provides users with information about who developed the HUB, what its purpose is, and who to contact in case of questions or if a user wants to add a best practice or resource to the HUB.

In addition, the ‘*About*’ page directs users to the ARCH project website⁷, the overview of the ARCH pilot cities⁸, as well as the overview of all project partners⁹.

⁷ <https://savingculturalheritage.eu/>

⁸ <https://savingculturalheritage.eu/cities/foundation-cities-1>

⁹ <https://savingculturalheritage.eu/about/the-partners>

2.2.2. How to build resilience

This section is meant to provide users with the foundational understanding of resilience, which is key to unpacking the ARCH resilience building process. The *'How to build resilience'* section includes the sub-page *'What is resilience?'* with an in-depth conceptualisation of resilience in the context of the ARCH project, and its relation to other concepts (see Figure 2).

Another sub-page titled *"What is a social-ecological system?"* explains the concept of historic areas as social-ecological systems and how this is related to cultural heritage and UNESCO's Historic Urban Landscape approach. This is also a fundamental building block to understand the resilience building process advocated by ARCH.

The *'How to build resilience'* section also includes a glossary of terms (subpage *'Glossary'*) where users can find all definitions used within the project.

Finally, the main sub-page *'The ARCH Resilience Framework'* provides users with a step-by-step explanation of the ARCH Resilience Framework (see Figure 3 as an example). Each step is described in detail to guide users in implementing the ARCH resilience building process – where possible with explanatory examples. In addition, for each step further – optional – tips are provided. All descriptions, examples, and further tips are based on the extended version of the ARCH Resilience Framework as developed for CEN Workshop Agreement 17727. For this, the content of the Workshop Agreement was broken down into an easier to understand and coherent text. Where suitable, the step-by-step guidance for the Resilience Framework links directly to the ARCH solutions provided in the resource hub.



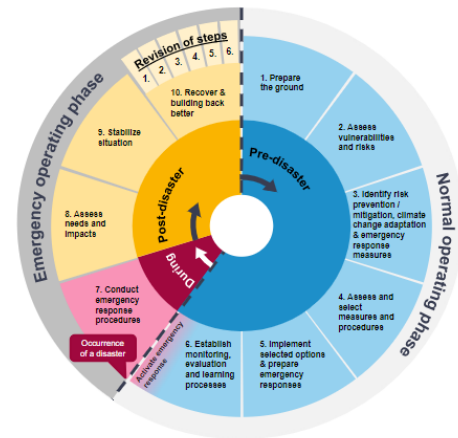
Figure 2: Example sub-page for the 'How to build resilience' section. Here: 'What is resilience'

1. Prepare the ground

The first step of the Resilience Framework is concerned with laying the foundation for all subsequent steps. You need to identify what the objectives of the process are, what its scope is, who is responsible for the overall process, and which stakeholders must be or should be involved from the outset.

In fulfilling this step, you create an assessment context that later serves as the basis for setting priorities and targets for the co-creation of a resilience strategy and a resilience action plan, as well as for the monitoring of progress by making use of indicators for resilient communities and historic areas.

The first action to be taken in this step is the **formation of a cross-sectoral resilience team or office** who works on the resilience building process and who will be responsible for mainstreaming resilience into traditional community practices. The resilience team has ownership of the resilience building process and is thereby accountable for the resilience strategy development. In order to do this efficiently, the resilience team needs to divide responsibilities among its members.



Example

The resilience team can be one main responsible person or a full team. However, the team should establish contacts to relevant departments and public/private organisations, local communities and other stakeholders to involve in the resilience building process, especially those representing minorities or disproportionately affected population groups. This can also include local businesses, academic institutions, cultural associations, and organisations from different governance levels that might support the process with financial and human resources.

Figure 3: An example extract from the step-by-step guidance for resilience building on the ARCH HUB

2.2.3. Best practices

The '*Best practices*' section provides users with an interactive directory of 40 best practices for local resilience building, as originally provided in D7.2 [4]. Users can filter them according to:

- *snapshot* (short description) or *case study* (detailed description);
- *main hazard(s)* the site under consideration is affected by;
- *main stressors* the site under consideration is affected by;
- the *disaster risk management phase(s)* that are covered; and
- the *type and subtype of measure* implemented at the site.

Each best practice is then described in further detail, containing more or less extensive information, depending on whether it is a snapshot or a case study. While only some basic background information can be found within the snapshots, case studies provide summaries of the main outcomes, success factors, and lessons learned.

The best practice directory will be extended over time. In fact, everybody who is interested to have their best practice featured in the directory, can contact the Fraunhofer team. In order to have a practice added to the directory, it is only necessary to fill in a template – provided upon request – with relevant information that will be reviewed by Fraunhofer.

2.2.4. Resource hub

The '*Resource hub*' section is a directory of methods, models, tools, handbooks, and other resources that can support in the resilience building process. While the resource hub prominently features the main ARCH tools, it is open to tools from different developers and projects. Currently the resource hub contains 29 resources, only five of which were developed in ARCH. Other resources come, for example, from the SHELTER project, or from established guidelines such as the Culture in City Reconstruction and Recovery (CURE) framework [10] or the Guidance Notes on Recovery from the International Recovery Platform (e.g., [11, 12, 13]).

The resources in the HUB can be filtered according to

- the *type* of resource (e.g., game, handbook, software, hardware);
- the *step(s) in the ARCH Resilience Framework* for which the resource might be useful;
- the *Essential of the Resilience Assessment Dashboard* for which the resource might be useful; and
- the *topic* addressed (e.g., climate change adaptation, disaster risk management, heritage management, or social justice).

For each resource, a detailed description is available. This description gives a short introduction, identifies the developer, what kind of usage conditions need to be met, and – if available – provides a link to access the resource.

As with the best practice directory, the resource hub will be extended over time. Developers and projects who are interested to have their resource featured in the ARCH resource hub can contact the Fraunhofer team, fill in a resource description template, and after a review might have their resource included in the resource hub.

In addition to these main materials, the resource hub also contains a sub-page that gives access to the ARCH Risk Scenario Toolbox, as described in D3.5 [14], i.e., the risk profiling table, risk scenario prioritization tool, and impact chain template used by ARCH to co-create risk analyses.

3. The ARCH RAD

The ARCH Resilience Assessment Dashboard is an online tool for self-assessing the resilience of a historic area. The key element of the tool is a questionnaire that can be answered by one or several users. The target audience

of the RAD are responsible persons for a historic area, such as heritage managers, urban planners, disaster risk managers and other actors, including professional organizations and community groups. Furthermore, the RAD follows a multi-stakeholder approach – several users can work on one resilience assessment and users are encouraged to consult additional stakeholders for answering questions of the questionnaire.

How to reach the ARCH RAD

<http://rad.savingculturalheritage.eu/>

Using the RAD and performing a resilience assessment results in one or more of the following benefits:

- By completing a resilience assessment users receive a resilience score – the resilience maturity level of a historic area – that indicates the performance in different aspects relevant for building resilience.
- By analysing the results, users can identify weak points that hinder the resilience of the historic area. Based on these results, users can formulate a list of actions for increasing the resilience capacity.
- By conducting several resilience assessments, the RAD can also be used to monitor resilience over time.
- Overall, using the RAD helps to become aware of the topics that need to be addressed in the resilience building process.

The questionnaire of the RAD is aligned with the concept of resilience applied by the UNDRR scorecard for cities – the Ten Essentials for Making Cities Resilient (see [section 3.2.2](#)). When completing a resilience assessment with the RAD, users receive a resilience score subdivided in ten categories (the Ten Essentials, adapted from the “UNDRR’s Ten Essentials for Making Cities Resilient” [15]). Via this categorization of the score users are enabled to analyse the different aspects of resilience of the historic area. The ARCH project also advanced the understanding of resilience of historic areas, defining it as *“The sustained ability of a historic area as a social-ecological system (including its social, cultural, political, economic, natural and environmental dimensions) to cope with hazardous events by responding and adapting in socially just ways that maintain the historic area’s functions and heritage significance (including identity, integrity and, authenticity).”* (see D7.3 [1]). The questionnaire of the RAD is based on this concept and users have – next to the Ten Essentials – the option to analyse achieved resilience scores according to (1) the social-ecological system dimensions, (2) disaster risk management phases; and (3) overall main topics heritage management, social justice, disaster risk management, and climate change adaptation.

In the following, the process of the methodological as well as technical development of the RAD and the overall functionalities of the RAD are described. A detailed description on how to use the ARCH RAD can be found in the [annex](#) of this document. This manual can also be found online integrated in the RAD <https://arch.iais.fraunhofer.de/faq>. In case of any further

developments and updates of the RAD beyond the ARCH project, the user manual to be found online will also be updated.

3.1. Overall development process

The RAD was developed over the course of the ARCH project within the tasks 7.3, 7.6 and 7.7 as well as co-created within task 3.4.5. In these tasks i) the content of the tool – the questionnaire – as well as ii) the technical realisation and iii) the tool functions and design were undertaken. An explicit explanation about the co-creation process linked to the RAD can be found in D3.6 [5]. The developments are based on requirements described in D7.4 [7] and the technical specification of all ARCH tools described in D7.5 [3]. The development process consisted of the following parts that are also explained in more detail in the following sections:

- i) In D7.3 ‘*ARCH Disaster Risk Management Framework*’ [1] the conceptual basis for the RAD was already provided. Based on this, one part of the further development of the RAD was the **content development of the questionnaire**. This included the creation of the categories of the questionnaire (the so called ‘Essentials’ and ‘Subessentials’), the formulation of questions as well as the predefined answers. A more detailed description of the content development process and the outcome can be found in [section 3.2](#).
- ii) The **technical realisation** of the RAD and the implementation of the concepts and functionalities was based on wireframes created by Fraunhofer (see [section 3.3.1](#)). A description of the implementation process and the technical setup can be found in [section 3.3](#).
- iii) The basic functionalities of the RAD were developed and formulated already early in the ARCH project and described as use cases in D7.5 [3]. These concepts as well as the **design of the tool** were brought to life and refined as wireframes and then adapted for the technical realisation. The final **functionalities of the RAD** are described in [section 3.4](#).

3.2. Content development of the questionnaire

3.2.1. Development process

The basic sources for the development of the questionnaire were the Disaster Resilience Scorecard for Cities [16] and the Disaster Resilience Scorecard for Industrial and Commercial Buildings [17]. These Scorecards are tools to perform self-assessments, i.e., questionnaires aiming to estimate the resilience level of a city or a building. The questions in the Scorecards are based on the UNDRR’s Ten Essentials for Making Cities Resilient [15], which are issues to be addressed to increase the disaster resilience of cities. The Ten Essentials support the implementation of the Sendai Framework for Disaster Risk Reduction and are directly related to the priorities of action and the indicators in the Framework.

Based on the Scorecards, a questionnaire, tailored to the specifics of historic areas, was developed. In a first approach, the Scorecards including all questions were analysed by the Fraunhofer team according to their suitability for the historic area context. Suitable questions were adopted, while questions that proved not to be relevant for a historic area were not

included in the ARCH resilience assessment. In addition to the Scorecards, related frameworks and tools were analysed for their approaches to building and managing resilience. These were used to gather ideas for structuring and developing the RAD, but also contributed to the development of the ARCH Disaster Risk Management Framework [1]. An overview of all frameworks and tools analysed in addition to the Scorecards can be found in D7.3. The main sources that contributed to the initial development of the Essentials include, e.g., the Guidance Notes on Recovery for Gender [12] as well as the Guidance Notes on Recovery for Climate Change by IRP and UNDP India, and the CURE Framework [10] by the World Bank and UNESCO. If an aspect was deemed relevant from these sources that was not represented in the Scorecards, an additional question was added accordingly. Following the review of relevant sources, the co-creation process with the project partners was a key step of the ARCH questionnaire development methodology, as described in D3.6 [5]. This allowed to identify and integrate different contexts and issues-based perspectives, especially from city partners, especially related to the applicability of questions to a practical context.

The overall aim of this process was to develop a questionnaire tailored to the specific needs and challenges of historic areas which require more detailed considerations and analyses that would not be needed at the city scale. A central concern was to take into account the comprehensive understanding of historic areas and resilience pursued within the ARCH project. This includes the following considerations:

- A historic area in the context of ARCH can be understood as a social-ecological system (SES), which includes not only the built environment but also the natural environment as well as social, cultural, economic, and political elements. Consequently, it needed to be ensured that all aspects of the socio-ecological system were taken into account when selecting questions.
- Historic areas can be part of a city and contain buildings, i.e., be close to the subject of the Scorecards; however, historic areas in ARCH can also be natural environments or landscapes (importantly in the case of València). Consequently, it was necessary to ensure that the different types of historic areas were equally covered by the questions.
- Resilience in the context of ARCH acknowledges that historic areas are social-ecological systems, leading to the distinction of different dimensions of resilience (structural, community and institutional). Furthermore, it recognises that responding and adapting to hazardous events must be both socially just and maintain the function and significance of a historic area. The aim was to ensure that the selection of questions encompassed all these resilience dimensions and topics.
- The Resilience Framework developed within ARCH is a guidance to support the resilience-building process. It combines disaster risk management (DRM) and climate change adaptation (CCA) and comprises ten steps (= DRM phases) required for the development of a resilience plan. The content and topics of the framework needed to be reflected in the questionnaire.
- Adapting historic areas against hazards may require different considerations than cities. In particular, the significance of heritage (values, ancient materials, old traditions etc.) needed to be considered when developing the questions.
- Responsibilities in a city are different from those in a historic area. City staff may have a different scope for decision making than a heritage manager. This had to be accounted for when selecting and adapting the questions.

3.2.2. The final questionnaire – The ten Essentials for making historic areas resilient

Taking these considerations into account, the questionnaire was developed as described in D3.6 [5]. The result is a set of 221 questions categorised into ten Essentials, each organised in 3 to 6 Subessentials (i.e., sub-topics). Changes were made to all Essentials from the original Scorecards and all questions including the associated answer options were revised and at least slightly adjusted in a multi-stage and co-creative process (see D3.6). Some were adapted by changing the wording of the questions or expanded by adding additional questions, while others were fundamentally revised. Furthermore, minor changes were made to the names of the Essentials where appropriate. The final set of Essentials is listed in Box 3.

An example of an Essential that has been substantially revised is Essential 4, which deals with pursuing resilient development. Essential 4 in the Scorecards is specific to urban development and covers topics like land zoning and managing urban growth as well as managing new buildings, neighbourhoods, and infrastructure. A large proportion of the questions in the original Essential is tailored to the scope of city staff and is not fully relevant to the responsibilities and tasks of historic area managers. Due to these different requirements, the approach to developing Essential 4 was peculiar. In a first moment, the Scorecards were used as a reference to get a rough picture of what the focus of the Essential should be and which topics should not be forgotten. More specifically, topics from Essential 4 in the Scorecards that were also considered important for the RAD include inhabitant engagement and regulatory frameworks and instruments.

As a next step the structure for Essential 4 was defined, based on the Historic Urban Landscape (HUL) approach developed by UNESCO [18]. In line with the HUL, the ARCH project takes a holistic approach to the management of historic urban landscapes and recognises that they do not only contain built environment, but form a dynamic context with economic, cultural and social spheres. The approach therefore supports active community involvement in the preservation efforts of a city or historic area. To implement the approach, the HUL proposes seven action steps, six of which were used to structure and formulate the Subessentials of Essential 4 (e.g., “Assessment of cultural heritage features”, “Consideration of socio-economic pressures and climate change impacts”). Once the basic structure of the Essential was established, various sources were analysed to fill the structure with content, i.e., questions. The sources analysed mainly include

- the Earthquake Master Plan for Istanbul [19],
- the Nomination Dossier [20] and Management Plan [21] by the Speicherstadt and Kontorhaus District with Chilehaus in Hamburg (both documents as part of the nomination for the UNESCO World Heritage List),
- a standard list of factors affecting World Heritage properties by the World Heritage Committee [22], and
- a report on identifying and inventorying intangible cultural heritage by UNESCO [23].

E01: Organise for resilience

This Essential covers organisational structures and identification of necessary processes to understand and act on reducing disaster risks.

E02: Identify and use current and future risk scenarios

This Essential handles identification and understanding of risk scenarios for the historic area and how to use this knowledge for decision making.

E03: Strengthen financial capacity for resilience

This Essentials handles the understanding economic impacts of disasters and the need for investment in resilience. In addition, it examines the identification and development of financial mechanisms that can support resilience activities.

E04: Pursue resilient development

This Essential handles the incorporation of critical knowledge of the historic area and external influences into development planning for the historic area. Development planning should also always aim to improve the resilience of the historic area.

E05: Safeguard natural capital

This Essential handles safeguarding natural capital to enhance the protective functions offered by natural ecosystems. In addition, it handles the identification, protection, and monitoring of critical natural capital assets and ecosystems services that confer a resilience benefit.

E06: Strengthen institutional capacity for resilience

This Essential examines the necessary capabilities for all institutions relevant to the resilience of a historic area to ensure that they can fulfil their roles.

E07: Increase social capacity for resilience

This Essential examines the broad understanding and continuous strengthening of societal capacity for resilience. It handles the cultivation of an environment for social connectedness which promotes a culture of mutual help through recognition of the role of cultural and natural heritage as well as education in disaster risk reduction.

E08: Increase resilience of supporting infrastructure and services

This Essential handles the assessment of the capacity and adequacy of structural protection measures for the historic area and supporting critical infrastructure systems. In addition, it handles initiation of necessary improvements of these measures and systems according to the risk scenarios identified for Essential 2.

E09: Ensure effective disaster response

Building on the scenarios for Essential 2, this Essential handles how to ensure effective disaster response.

E10: Expedite recovery and build back better

This Essential handles pre-disaster recovery plans based on the identified risks for essential 2. After a disaster, the needs of the affected people should be prioritised in recovery, reconstruction, rebuilding processes.

(Box 3)

Ideas that emerged from the analysis of the Earthquake Master Plan for Istanbul include, for example, promoting an active role for the community in building resilience, considering the importance of complete information on the historic area concerned (inventories, spatial information, etc.) and that in disaster risk management not only the response phase but also the preparedness and mitigation phase should be taken into account. The Nomination Dossier [20] and Management Plan [21], as well as the above-mentioned list by the World Heritage

Committee [22], provided food for thought particularly on issues of legal instruments, planning tools and frameworks as well as socio-economic pressures that might affect the historic area. The report on intangible heritage helped to formulate questions on the identification and assessment of intangible heritage features.

Similar to the other Essentials of the RAD, the development of Essential 4 was an iterative process. Since the Scorecard did not serve as a pre-defined basis as with the other Essentials, the quality and applicability had to be ensured all the more. This was done through a collaborative process as described in D3.6, which included two co-creation workshops – one more than for the rest of Essentials. From these workshops, further suggestions and ideas from the project partners could be gained, which led to additional questions, e.g., on monitoring the development status of the historic area.

A further approach to address the considerations mentioned in the end of [section 3.2.1](#) and to reflect them in the questionnaire (e.g. taking into account the comprehensive understanding of resilience in ARCH) was to indicate for each question the reference to the corresponding resilience dimensions, resilience topics and DRM phases. On the one hand, this supports the relation to and handling of the ARCH DRM Framework and, on the other hand, it helps to tackle specific thematic weak areas of resilience. An example question with corresponding assignment of themes is shown in Box 4.

“Are all critical documents, manuals and disaster procedures/plans relating to the historic area, its structures, equipment, and its people (residents, employees, etc.) both securely stored off site and available for use during and after a disaster?”

Related DRM phases:

- Prepare the ground
- Establish monitoring, evaluation and learning process
- Conduct emergency response
- Recover and building back better

Related resilience topics:

- Disaster risk management
- Heritage management

Related resilience dimensions:

- Built Environment
- Natural Environment
- Policy
- Culture

(Box 4)

To summarise, the questionnaire was developed on the basis of the Scorecards and with the aspects mentioned in the end of [section 3.2.1](#) in mind, resulting in an adapted and expanded questionnaire. This included adopting appropriate questions from the Scorecards and adapting some others, considering relevant sources, including additional questions and finally adding resilience-related information to all questions.

This advancement ensures that the questionnaire is appropriate for the specifics of historic areas and captures the comprehensive topic of resilience in all its aspects. It also allows users to identify specific thematic weak areas of resilience. How this is supported by the RAD's features and what other features are available is explained in the [section 3.3](#).

3.3. Technical realisation¹⁰

The technical realisation of the RAD comprised the development of an online survey tool that presents the questionnaire to the users and allows to answer the questions that are structured by certain topics – the (Sub)essentials. Based on the given answers, the tool computes and displays a resilience score for a historic area. Thereafter, the tool provides the possibility to document actions aiming to improve the resilience of the historic area. Furthermore, the tool offers the possibility that several users work collaboratively on one assessment.

3.3.1. Technical development process

The overall development process of the RAD was agile and had a strong focus on gathering feedback from the partner cities as set by the co-creation method and outlined in D3.6 [5]. In the beginning, the general functionalities were defined based on the outlined vision of the RAD and used to define the system architecture and general order of features to be implemented.

The RAD includes six technical modules covering all main functionalities of the RAD:

- The '*Assessment Core*' module contains the main feature of the tool. It includes all functionalities related to displaying, navigating and question answering within an assessment.
- The '*Score Component*' processes the user inputs, calculates the score, and gives a comprehensive overview of the given answers.
- The '*Actions Component*' revisits the given answers and provides input capabilities for planned actions.
- The '*User Management*' provides all functionalities related to user accounts, access rights and management of user groups.
- The '*Questionnaire Management*' addresses all functionalities required to create and update the questionnaire within the tool.
- And finally, the '*User Guidance*' contains all features that aim to explain the RAD to the user and make it more accessible.

Due to the agile process, core components of the modules were developed first, and additional features were added subsequently. For each component, an initial user interface design was created as well as a description of the desired functionalities using wireframes. Usually, after an initial creation, wireframes were refined in feedback loops within the Fraunhofer team. For example, Figure 4 shows an early version of the wireframe for the RAD structure and the page

¹⁰ Screenshots for each of the implemented functions can be found in the user manual in the [Annex](#).

where questions are answered, whereas Figure 5 shows the refined version of the same wireframe. Based on the wireframe, the component was then implemented and afterwards reviewed from a functional and technical point of view. Occurring problems were documented and troubleshooted with the help of an issue tracker.

ARCH RAD 1 Explanation 2 Chose scope 3 Questions 4 Resilience scores 5 Overview Question Catalogue

ARCH RAD
Conducting the resilience assessment

- 1 Explanation / How to
- 2 Chose scope
- 3 Questions
- 4 Resilience scores
- 5 Overview

User profile
Workspace
Go back to the ARCH Hub

Overall progress: 1 / 221 questions answered

Essential 01: Organise for resilience

- Subessential 1.1: Planning for resilience (Progress: 1 / 13)
- Subessential 1.2: Organisation, coordination, participation
- Subessential 1.3: Routine consideration of resilience issues in all decisions
- Subessential 1.4: Data capture, publication and sharing

Questions Please chose one answer per question

1.1.1 Existence of strategies to maintain and improve resilience

Do local plans / strategies exist to increase or maintain the disaster resilience of the historic area?

Click here for additional information

No plans
Plans are at best rudimentary and of doubtful value
Plans have major omissions or inaccuracies
Some plans exist, but they have gaps
Comprehensive plans exist, but they may be in need of minor updates
Up-to-date plans exist

Further information

Type in your comment

1.1.2 Consideration of social-ecological sub-systems in resilience planning

Are all relevant social-ecological sub-systems of the historic area considered in the resilience strategy?

Not considered
Only very few parts of the social-ecological system are mentioned in the resilience strategy
A few sub-systems are considered in the resilience strategy
Some sub-systems are considered in the resilience strategy
Most sub-systems are included in the resilience strategy
All relevant social-ecological subsystems are included in the resilience strategy

Type in your comment

Figure 4: Early version of a wireframe for the question page of the RAD

ARCH RAD
RESILIENCE ASSESSMENT DASHBOARD

You are working on the resilience assessment: Devin castle xyz

Steps: 1 Chose scope 2 Answer questions 3 See scores 4 Plan options 5 Exit assessment

How to Historic area User Profile

Current essential: E01: Organise for resilience

Current subessential: 1.1: Planning for resilience

Export PDF

Progress current subessential: 5 / 25 questions answered

Overall progress: 5 / 221 questions answered

1.1.1 Existence of strategies to maintain and improve resilience

Do local plans / strategies exist to increase or maintain the disaster resilience of the historic area?

Does not apply Do not know Please insert any comments here:

0 - No plans.
1 - Plans are at best rudimentary and of doubtful value.
2 - Plans have major omissions or inaccuracies.
3 - Some plans exist, but they have gaps.
4 - Comprehensive plans exist, but they may be in need of minor updates.
5 - Up-to-date plans exist.

"additional information text"

1.1.2 Consideration of social-ecological sub-systems in resilience planning

Figure 5: Final version of the wireframe for the question page of the RAD

Once a new component was finished and made available, different users were asked to provide feedback after testing the software in its online version, to be considered in the revision of the tool.

3.3.2. Overview of system structure

The overall architecture of the RAD is a basic web application that consists of a database, backend, and frontend. The application is served through a web server and reverse proxy. For the user management it was decided to use a standard component since the requirements for the RAD could be realised with existing solutions. Since the questionnaire is already available in a semi-structured format (spreadsheets) and the questions are expected to be stable, it was decided to maintain the questionnaire in the same format and to import the changes when required. To ease portability of the tool, the operation systems are virtualised using containers.

For the selection of appropriate technologies for the realisation of the architecture the following criteria were applied: dissemination (industry standards), availability of source code, licencing, compatibility, and skills of project team were considered. As a result, the following technology stack was used: Keycloak¹¹ (user management), PostgreSQL¹² (database), Angular¹³ (frontend), SpringBoot¹⁴ (backend), NGIX¹⁵ (web server/proxy), Docker¹⁶ (OS-level virtualization).

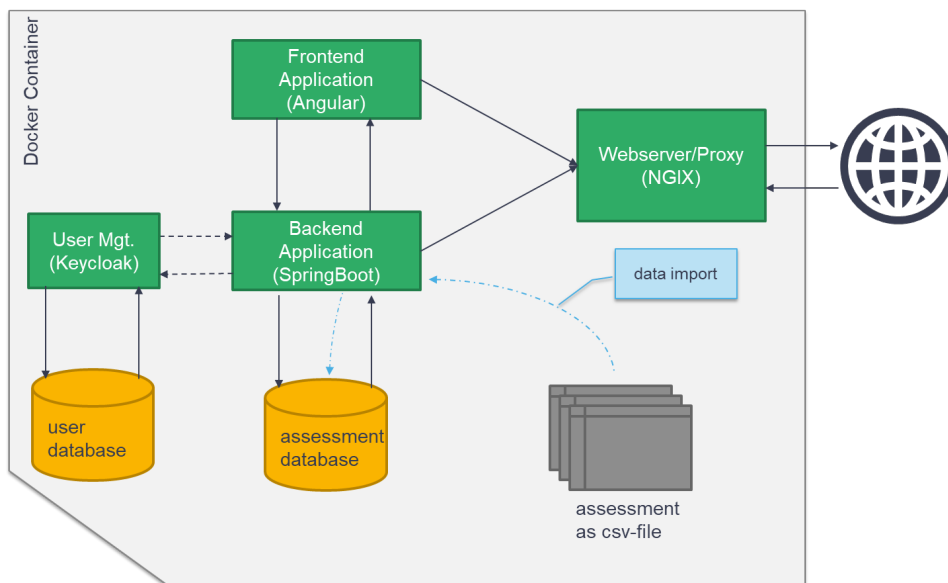


Figure 6: Visualisation of the RAD system structure

¹¹ <https://www.keycloak.org/>

¹² <https://www.postgresql.org/>

¹³ <https://angular.io/>

¹⁴ <https://spring.io/projects/spring-boot/>

¹⁵ <https://www.nginx.com/>

¹⁶ <https://www.docker.com/>

The user database stores user profiles information such as email address and name. The assessment database stores the questionnaire including the names of the Essentials, Subessentials, and the questions as well as the user filled-in questionnaires. The user management component accesses the user database and carries out the authentication for the backend and frontend component. For that, the frontend links to the login page of the user management and after successful authentication a web token is generated. The token is then used by the frontend to authenticate the user in the backend.

The backend follows the Model-View-Controller pattern of SpringBoot, however it only servers a REST-API which provides data in JSON format for the frontend. The frontend is structured by the different views presented to the user. Moreover, the textual information of the user interface is available in multiple languages. The webserver resolves the requests and routes them to the responsible components.

3.4. How the RAD works

User-friendliness was deemed to be an essential feature of the RAD, as such the RAD was designed to provide a simple and straightforward way to work with it and navigate through it. For example, when starting on the landing page of the RAD, users can directly see their options on “*what to do on the RAD*” provided by prominent buttons. Furthermore, when conducting a resilience assessment, users are guided with arrow-buttons through the assessment and can follow a navigation bar that visualises the four steps of the assessment (see [section 3.4.1](#)). In the following paragraphs, a brief overview of the different user roles, the different RAD functionalities, as well as of the meaning of the scoring is provided. A detailed user manual on how to use the RAD and its functions can be found as an [Annex](#) to this document.

Every user visiting the RAD is able:

- to access the landing page;
- to access the Frequently Ask Questions (FAQ) section with several questions and answers about the RAD and the user manual to download; and
- to register / login for the RAD.

A logged-in user can perform a resilience assessment either in the ‘*user area*’ or within a ‘*historic area workspace*’. A workspace must be requested to the ‘*RAD administrator*’ (i.e., Fraunhofer team member) who can approve, deny, or disable a workspace within the RAD. A historic area workspace can be accessed by multiple users and therefore offers the possibility for these users to work collaboratively on one assessment. The user that requests the workspace is automatically the ‘*administrator of the workspace*’ and is allowed to add or remove other users.

This above-mentioned setup varies slightly to what is described in D7.5 [3]. In the ‘use cases’ – the main functionalities of the tools – described (see D7.5, section 5), RAD users should have been able to perform a quick resilience assessment without logging in beforehand. However, since partners from the ARCH pilot cities requested during the co-creation process that the results of the assessments should be saved by default and should only be accessed by certain users, this functionality was left out and only logged-in users can perform a resilience assessment now. Furthermore, since the ARCH HUB and the ARCH RAD are loosely coupled

(see [section 4](#)), the login is now only performed via the RAD, and not as originally stated via the ARCH HUB. In addition to the above-mentioned points, there is also no functionality for users to share their resilience assessments on the ARCH HUB, since the scores are kept private within the user profile or the workspace, as requested by partners during the co-creation process.

The core of the RAD is the performance of a resilience assessment. Every resilience assessment consists of the following four steps that a user can navigate through:

- Step 1 – ‘*Choose scope*’: The user can choose if a quick or detailed assessment should be performed. In addition, the assessment can be refined, and a user can choose individual Essentials to be included/excluded.
- Step 2 – ‘*Answer questions*’: The user is guided through the questionnaire according to (Sub-)Essentials. For each question, an answer should be chosen, comments can be given and additional information on how to answer and understand the question can be accessed, if available.
- Step 3 – ‘*See score*’: The overall resilience score is displayed as well as breakdowns of the score into different Essentials or other topics relevant for resilience of historic areas (see [section 3.4.1](#)).
- Step 4 – ‘*Plan options*’: The user can again navigate through the questions and answers and, based on them, formulate actions that can increase the resilience, respectively.

The scores (Step 3) as well as the formulated planned actions (Step 4) can be exported as pdf files.

The tool is accessible in English as well as in the languages of the ARCH pilot cities: Italian, Spanish, Slovak and German.¹⁷

3.4.1. The resilience scores

After completing the questionnaire and clicking on ‘*See score*’, several resilience scores are visualised. Sample scores and descriptions of the various visualisation of the scores can be found in the manual provided in the [Annex](#).

For each completed assessment, an overall resilience score is calculated. This score results from the sum of the scores of all questions that were answered in the assessment. For every question, an integer score between 0 and 5 is given based on the answer provided by the user. In case a question is answered with ‘*not applicable*’, the question is not accounted in the overall score and in case the answered is ‘*not known*’, it is counted as 0. Every question is equally weighted based on the concept and understanding of resilience described by the ARCH project (resilience constituting of various aspects strengthening each other and all accounting for

¹⁷ Note that due to the extent of the questionnaire, only the menu and certain text passages (e.g., on the landing page) are currently translated.

resilience in the same way). Consequentially, the scores for each (Sub-)essential are calculated in the same way and are also displayed on the scoring page.

In addition, the scores can also be visualised in categories related to the concept of resilience outlined in the ARCH project (see D7.3 [1]). The additional categories should provide the user with information on how well resilience is built up considering further viewpoints other than the categorisation into the ten Essentials. These additional categories are the following:

- *'Topics'*
 - Disaster risk management
 - Climate change adaptation
 - Heritage management
 - Social justice
- *'Disaster Risk Management Phases'*
 - Pre-disaster: Prepare the ground, assess vulnerabilities and risks, identify measures, assess and select measures, implement measures, establish monitoring-, evaluation- and learning processes
 - During-disaster: Conduct emergency responses
 - Post-disaster: Assess needs and impacts, stabilize situation, recover and building back better)
- *'Resilience Dimensions'*
 - Built Environment
 - Natural Environment
 - Economy
 - Policy
 - Society
 - Culture

The mapping of the questions to the additional categories was done during the development process of the questionnaire. Each question was mapped to one or several of these (sub-)categories. Due to this multiple mapping, where one question can belong to multiple scores, the scores within these categories are only shown in percentage of the overall possible score for this category to avoid confusion.¹⁸ Example scores are provided in the manual (see [Annex](#)). Examples of actual resilience assessment scores achieved by ARCH partners can be found in D3.7 (see [6]).

¹⁸ Showing the absolute score could result in confusion, as the sum over all categories could be larger than the overall resilience score, as questions related to multiple topics could be counted twice.

4. Integration with other tools

As described in D7.5 [3], the complex nature of ARCH's solution landscape – which includes handbooks, sensors, geo-information systems, databases with and without access via public interfaces, all developed using different technologies – made a strong coupling between solutions within one single integrated platform almost impossible. In addition, feedback from the pilot cities during the co-creation process made clear that a very loose coupling between the different solutions offered by ARCH would be more desirable. On the one hand, this allows easier consideration of existing legacy systems and processes within the pilot cities – and thus facilitates easier local adoption of the ARCH solutions – as well as an easier exploitation of individual solutions after the project. On the other hand, it allows technical partners to progress the developments of their solutions more independently – in terms of time and personnel resources – which made it possible to adapt the co-development process of individual solutions to the needs of the pilot cities, resulting in solutions that better fit to the actual needs of the end-users.

As a result of this process, the integration between the ARCH solutions is mainly achieved via the ARCH HUB, where end-users can find detailed descriptions of each solution in the resource hub, including how to access them and for which step of the ARCH Resilience Framework they can be employed. The HUB integrates these solutions wherever possible, e.g., by providing links to the ARCH solutions within the detailed description of the resilience building process.

The only exception to this integration approach are the Resilience Assessment Dashboard and the Resilience Measures Inventory. These two solutions are integrated more strongly with each other. Specifically: during the development processes, Fraunhofer and TecNALIA have continuously mapped topics from the questions of the RAD with the measures contained within the RMI. The result is that the RMI contains two filter fields, one for filtering measures according to the essentials of the RAD and another one to filter measures according to Subessentials of the RAD – on top of filtering for different phases of the disaster risk management cycle. These filters allow users that have completed a resilience assessment using the RAD to identify measures in the RMI that might help them raise their resilience score in (sub)essentials where weak spots were identified. To further facilitate the use of the RMI to address weak spots identified with the RAD, the 'plan options' step within the RAD contains a direct link to the RMI.

5. Conclusion and next steps

This document described the development process and the resulting tools from WP7 – the ARCH HUB and ARCH RAD, which collectively constitute the ‘*ARCH management platform*’ (also called ‘*ARCH data and information platform*’). For both tools the concept design, the content creation as well as the technical integration and final setup was explained.

Following the input from the co-creation process (see D3.6 [5]), the ARCH HUB was developed into knowledge base for resilience building that provides detailed information on how to apply the ARCH Resilience Framework [1], showcases best practices in resilience building and provides a directory of tools, methods, handbooks, and other resources for resilience building. The RAD on the other hand, was developed as a web tool for self-assessing the resilience of historic areas that allows to collaboratively evaluate and monitor the resilience maturity of a historic area, identify resilience weak spots, and formulate actions to increase resilience.

The tools are publicly available and can in principle be used by everyone. They will be maintained by Fraunhofer for the foreseeable future and at least for two years after the project ends.

Fraunhofer plans to use and integrate the tools in follow-up projects, e.g. in the upcoming Horizon Europe project RescueMe (will be a funded project under HORIZON-CL2-2022-HERITAGE-01-08; GA no. 101094978). In addition, Fraunhofer plans to explore adapting the RAD to other contexts, e.g., resilience of smart cities or sustainability of cities and businesses. The technological basis of the RAD allows moderately easy adaptation for such exploratory work.

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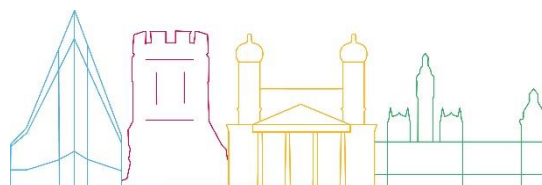
Annex: RAD manual

The RAD user manual can be found on the following pages (page 33 - 56 of this document).



ARCH RAD manual

A step-by-step guide on how to use the ARCH RAD



This document has been prepared in the framework of the European project ARCH – Advancing Resilience of historic areas against Climate-related and other Hazards.

The sole responsibility for the content of this publication lies with the authors. It does not necessarily represent the opinion of the European Union. Neither the REA nor the European Commission are responsible for any use that may be made of the information contained therein.

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement no. 820999.

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1. Introduction

Welcome to the RAD manual. This document provides detailed step-by-step instructions on navigating the RAD and completing the assessment. The RAD (Resilience Assessment Dashboard) is an online questionnaire which enables you to assess the current resilience level of your historic area. There are no requirements to start. You can simply follow the instructions given here and soon start your first resilience assessment. In the following chapters you will learn [how to create a user profile \(chapter 2\)](#) and a [historic area workspace \(chapter 3\)](#) as well as [how to carry out the actual assessment \(chapter 4\)](#). Resilience assessments can either be done as an individual using your user profile or they can be done in collaboration with other people using the historic area workspace.

To start off, Figure 1 gives an impression of the RAD homepage. The buttons below the welcoming text “Learn more about the RAD” and “Sign in / Register to use the RAD” are twins of the buttons in the top-right corner labelled “FAQ” and “Sign in” and are enlarged and centered for easier access to newcomers. The question mark buttons redirect you to a page that answers some of the most important questions about the RAD that help inform you before diving into the tool. The buttons with the sign in logo forward you to a page where you can log in or register depending on whether you have created a user profile before or not.

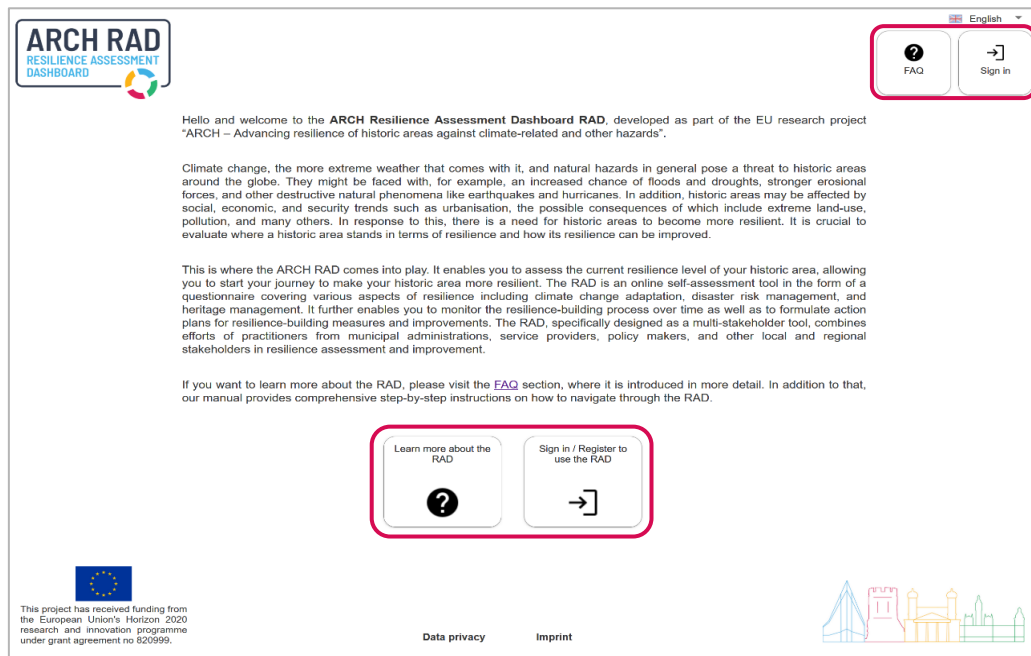


Figure 1: RAD homepage when you are not logged in.

Otherwise, enjoy, explore, and have fun with the RAD!

2. Create a user profile

First-time users must register and create their own user profile to gain access to the RAD. By clicking on the button depicted in Figure 2 which is placed on the [RAD homepage](#) (see image [chapter 1](#)) you are forwarded to a page where you can either sign in, if you already have a profile, use the option “Forgot Password?”, if you do not remember your login credentials, or register, if you are a new user. If you want to save your login credentials to the website, you can check the box “Remember me” above the “Sign in” button. In the top-right corner of the dialogue you can also display the website and its buttons in a different language. The RAD questions are always displayed in English. Available languages for translating the website are German, Italian, Slovak and Spanish.

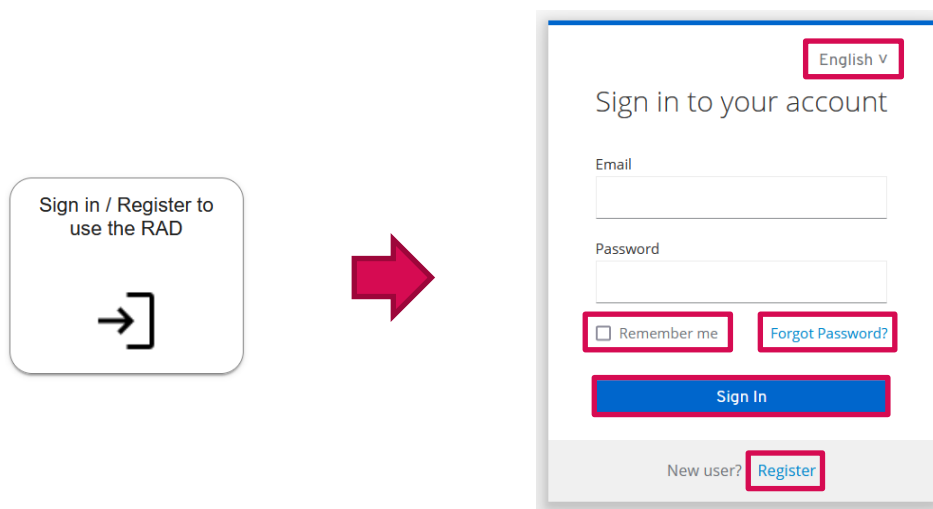


Figure 2: Button to sign in or to register to use the RAD and the page you will be directed to when you click on the button.

To register, type in your first and last name, an email address as well as a password, which you must confirm by repeating the password. Use the “Register” button to complete your registration. The last step is to verify your email address. Please check your emails and click on the link in the email that has just been sent to you. If no email arrives, you have the option of re-sending the email (Figure 3) or checking your spam folder. If you are unsuccessful, you might have misspelled your email address and have to re-register. In any case, you can contact the [RAD team](#) for support.

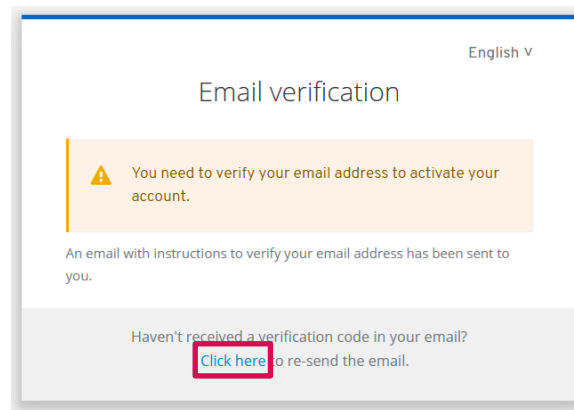


Figure 3: After using the “Register” button, this window appears which asks you to verify your email address.

Once you are logged in, three buttons will be available on the homepage below the welcome text (Figure 4). You can either learn more about the RAD and how it works in the FAQ section (❓, this section is also available without an active user profile). Or you have the options of starting a resilience assessment that is linked to your user profile (👤) and/or creating a historic area workspace (🏰) through which you can share and jointly work on an assessment with others. The three buttons on the top right are again twins of the buttons in the middle. As can be seen, the navigation buttons both in the middle and in the top right corner change once a user is logged in.

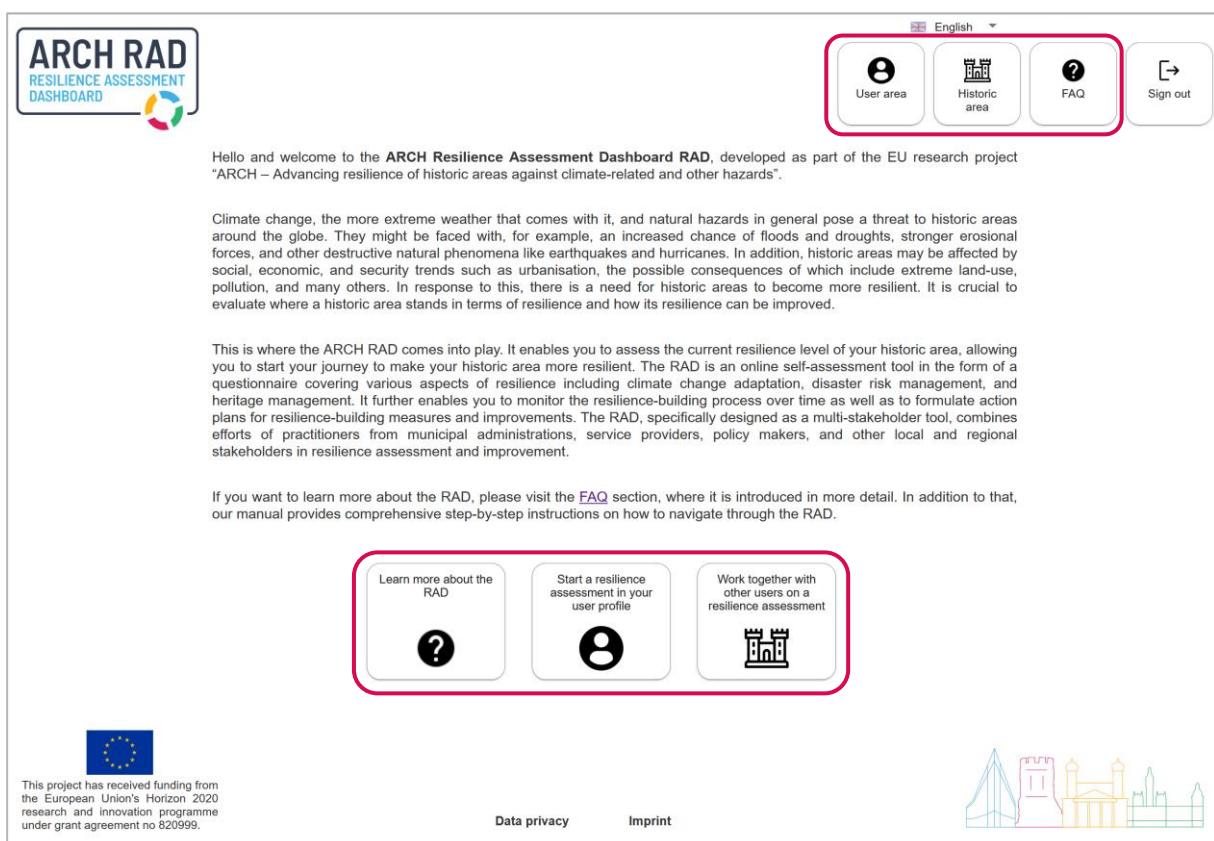
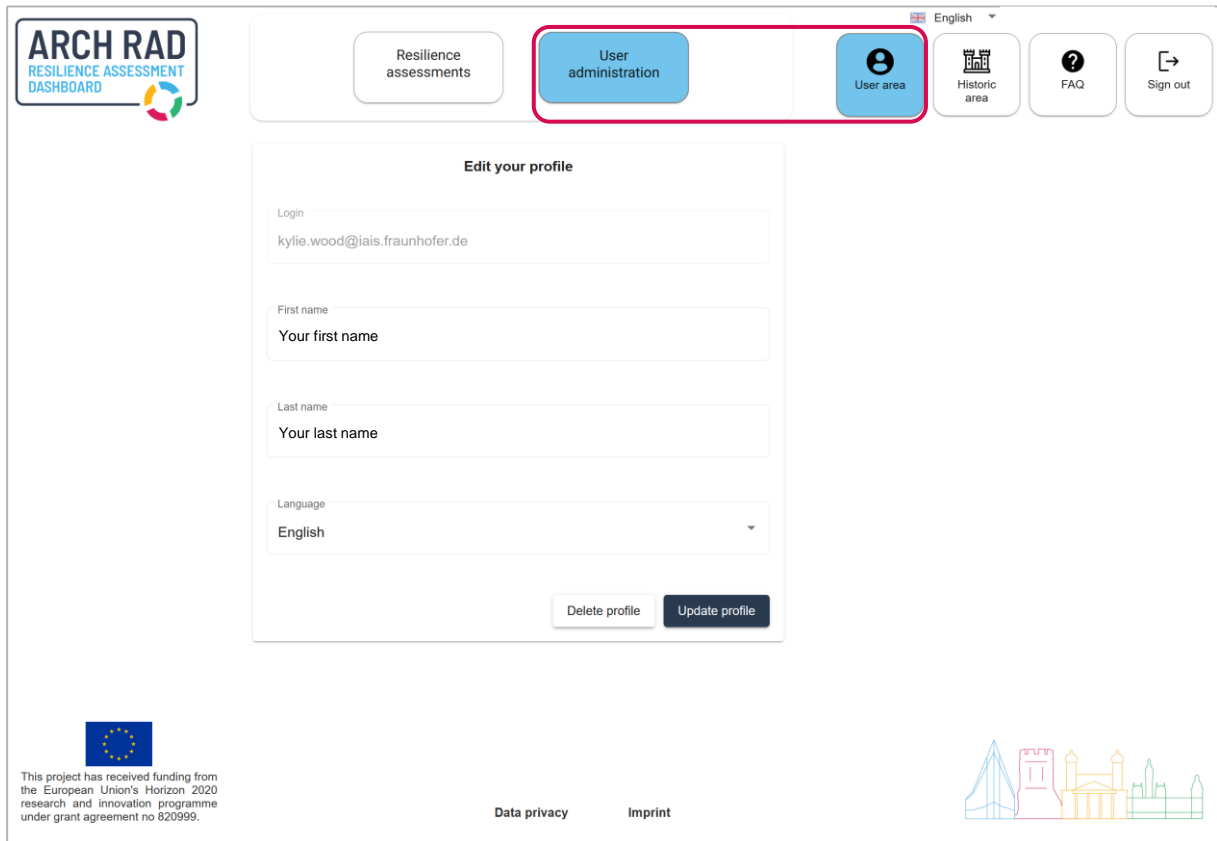


Figure 4: RAD homepage after you have logged in.

By accessing the user area (9) and opening the user administration (Figure 5), the users can change their user information and settings and update their profile or delete their profile entirely. Besides managing user information, the user can start a resilience assessment in this area, which is described in [chapter 4](#). The creation and functions of a historic area workspace are described in the next [chapter 3](#).



The screenshot displays the ARCH RAD Resilience Assessment Dashboard. The top navigation bar includes the ARCH RAD logo, a language selector set to English, and several menu items: Resilience assessments, User administration (highlighted with a red box), User area, Historic area, FAQ, and Sign out. The main content area is titled 'Edit your profile' and contains the following fields:

- Login:** kylie.wood@iais.fraunhofer.de
- First name:** Your first name
- Last name:** Your last name
- Language:** English (dropdown menu)

At the bottom of the profile form are two buttons: 'Delete profile' and 'Update profile'. The footer includes the European Union flag, a funding notice, links for 'Data privacy' and 'Imprint', and a colorful illustration of a city skyline.

Figure 5: User administration in user area where updates can be made to a user profile.

3. Create a historic area workspace

To create a historic area workspace, you must enter the historic area button of the RAD (🏰) as shown in Figure 6. The historic area workspace helps you gather key information, for instance about hazards your area is confronted with. Furthermore, it enables you to work with different people on the same assessment by linking their user profile to the respective historic area workspace. If you do not know yet whether you want to work on one assessment with several people, it is advisable to use the historic area workspace anyway and start your assessment via this area as this way you can also connect other user profiles at a later stage. If you want to assess different historic areas, it is also possible to create a separate workspace for each of these. All historic area workspaces that are linked to your profile will be listed there.



Figure 6: To create or work in a historic area workspace, you can click on the historic area button located both in the centre and top right of the RAD homepage.

If you do not have any workspaces linked to your profile yet, the page looks like shown in Figure 7. Click on the button “Request a new historic area workspace”.

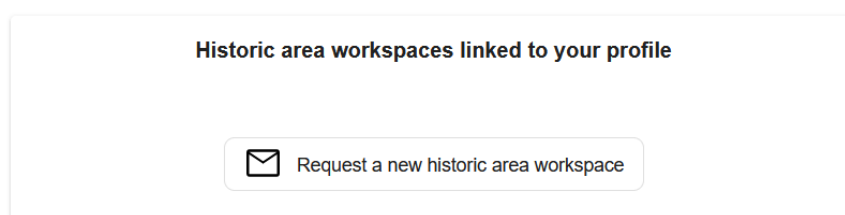


Figure 7: This is what the page looks like when you do not have any workspaces linked to your profile yet.

The next window allows you to give your new historic area a name and to specify in which city or region it is located (Figure 8). After clicking “Send request”, the message “Your request was successfully submitted.” is displayed right above the button. Once the new historic area workspace is processed and added to the RAD, you will receive an email. As each request is reviewed by a member of the RAD team, it might take up to 24 hours until your historic area workspace is approved. Usually, this will only take a few minutes. If it gets rejected or if you do not receive an email at all, you can contact the RAD team (arch-support@iais.fraunhofer.de).

Figure 8: When you create a new historic area workspace, you will be asked to enter the name and region of your historic area and to send the request for approval.

In case your historic area workspace was approved, you can follow the link received by email and the page below the historic area button should look like shown in Figure 9 (in this case, two workspaces were created and linked to the profile):

Figure 9: This is what the page looks like when your historic area workspace request was approved.

If you click on one of your historic areas, you enter the workspace of that area where you can collect general information on the historic area, but also information on the specific risk characteristics that the area is faced with (Figure 10). These two sections can be accessed by using the corresponding button at the top.

You are in the **Women's Rights National Historical Park** workspace

ARCH RAD
RESILIENCE ASSESSMENT
DASHBOARD

Information Risks characteristics Resilience assessments User management Close workspace

User area Historic area FAQ Sign out

Here you can insert additional information about the historic area. Having these present can help to perform a resilience assessment.

Name
Women's Rights National Historical Park

City/Region
Seneca Falls

Built environment assets

Movable heritage assets

Supporting infrastructure assets

Figure 10: Sections “Information” and “Risk characteristics” in the historic area workspace.

The buttons also guide you to the sections “Resilience assessments” and “User management”. In “Resilience assessments” you can start new assessments (view highlighted button in Figure 11) as well as continue assessments you have already started or re-examine completed assessments. How to start new assessments is covered in [chapter 4.2](#).

You are in the **Women's Rights National Historical Park** workspace

ARCH RAD
RESILIENCE ASSESSMENT
DASHBOARD

Information Risks characteristics Resilience assessments User management Close workspace

User area Historic area FAQ Sign out

Start resilience assessment

Assessment name	Status	Overall resilience score	Created by	Created at	Updated at	Completed at
-----------------	--------	--------------------------	------------	------------	------------	--------------

Figure 11: Section “Resilience assessments” in the historic area workspace where you can start new assessments or continue assessments you have already started or re-examine completed assessments.

To continue or re-examine older assessments, click on either the assessment name in the list or the button towards the end (🔍) (Figure 12). In this view you can also retrieve the information when the assessment was last updated, which can be helpful if you are working with several people on one assessment.

You are in the **Women's Rights National Historical Park** workspace

ARCH RAD
RESILIENCE ASSESSMENT
DASHBOARD

Information Risks characteristics Resilience assessments User management Close workspace

User area Historic area FAQ Sign out

Start resilience assessment

Assessment name	Status	Overall resilience score	Created by	Created at	Updated at	Completed at
ResAss_WRNHP_20220615	In Progress	69 / 475	your.email@address.org	05.07.2022, 12:14:54	05.07.2022, 12:16:57	🔍
ResAss_WRNHP_20220705	In Progress	26 / 840	your.email@address.org	05.07.2022, 12:13:42	05.07.2022, 12:14:01	🔍

Figure 12: Section “Resilience assessments” in the historic area workspace with two assessments started.

In the “User management” section (Figure 13) you can add other users to your historic area workspace so that you can share the general information and jointly work on the assessments linked to the historic area workspace. The other user must be registered on the platform for you to be able to directly add them to your historic area workspace. Otherwise, you can send an invitation to the RAD via email. Once this email address is registered on the platform, the user will automatically be linked to the historic area workspace through which the invitation was sent.

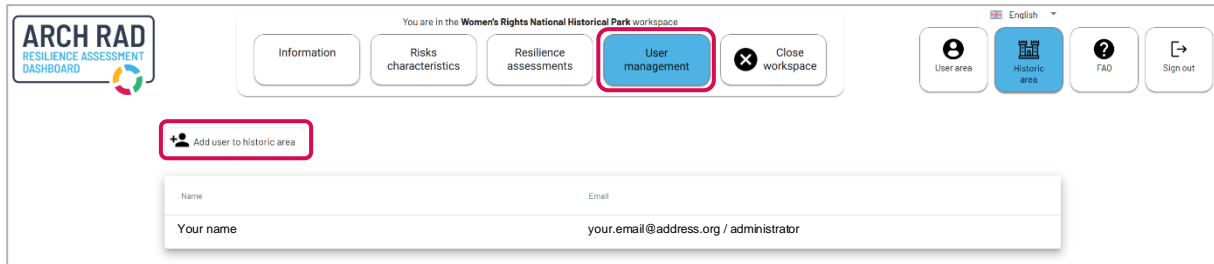


Figure 13: Section “User management” in the historic area workspace.

If several user profiles are connected to a historic area workspace, the users are listed with their email address as shown in **Figure 14**. The user who created the workspace is the administrator by default but can transfer the administration right to another user by clicking on the button marked below (👤). As an administrator, you have the right to add users to the historic area workspace (+👤) as well as remove them from the workspace (👤). If you click on the latter button (👤) next to your user profile, you will remove yourself from this workspace. To re-enter, you must contact the administrator of the workspace.

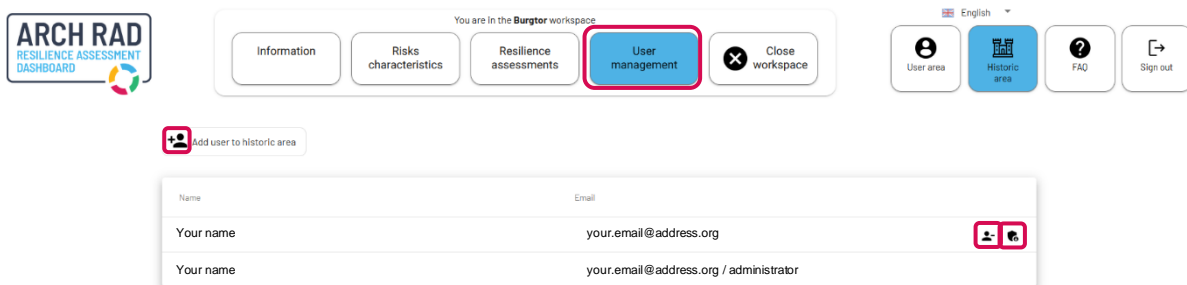



Figure 14: Section “User management” in the historic area workspace.

4. Complete the assessment

This chapter comprises seven subchapters and gives you detailed instructions on:

- how to [start the assessment](#),
- how to [choose the scope](#),
- how to [navigate the assessment](#),
- how to [answer the questionnaire](#),
- how to [check your scores](#),
- how to [make an action plan](#),
- and finally, how to [finish the assessment](#).

4.1. Start the assessment

Make sure you are [logged in](#). You can either start the assessment in your [user area](#) or as part of a [historic area workspace](#). Starting an assessment in your user area can be done if you are sure that you will work on the assessment alone. If you want to work with several people on one assessment or keep this option open, it is advisable to start an assessment as part of a historic area workspace. Click on either of the two buttons (“User area” or “Historic area”) in the top-right corner to access the areas. In both instances you will have an overview of all previously started and/or completed assessments, with an option to continue the incomplete assessments via the -button or clicking on the name of the assessment, and a button to “Start [a new] resilience assessment”. Starting or continuing an assessment in the user area is shown in Figure 15.

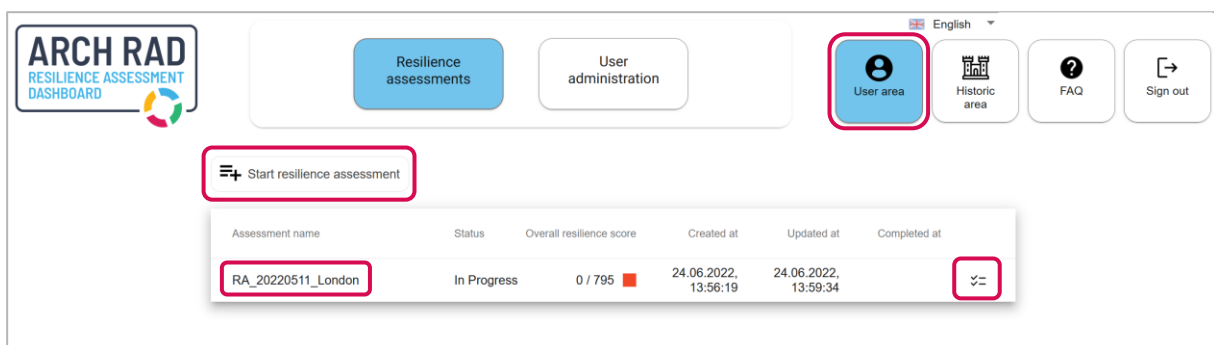


Figure 15: You can start or continue an assessment in your user area which is recommendable only if you want to work as a single person on your assessment.

Starting or continuing an assessment in your historic area workspace will look like shown in Figure 16.

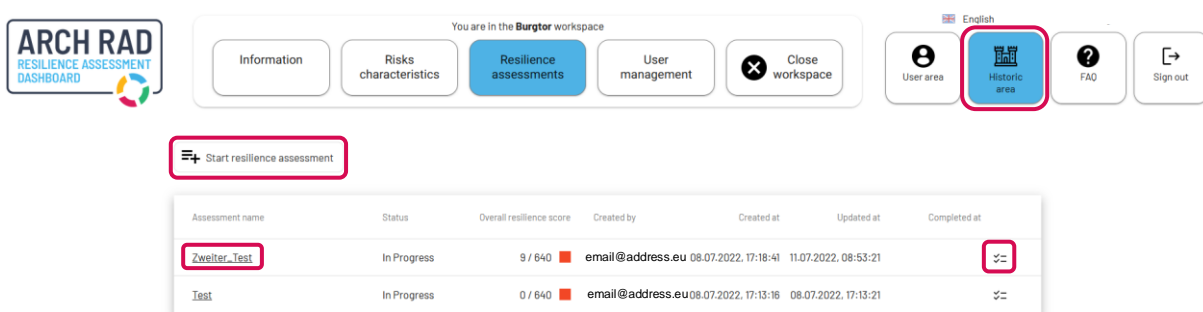


Figure 16: You can start or continue an assessment in your historic area workspace which is recommendable if you want to work with other people on one assessment.

The further assessment process described on the following pages is the same in both areas. However, the difference is that for assessments in the historic area workspace, all users connected to the workspace will be able to modify the assessment and provide comments. For assessment in your user area, only you will be able to work on the assessment. After choosing to start the resilience assessment the window shown in Figure 17 below pops up. For you to

be able to store and later resume your assessment, the assessment session needs a unique name with which your assessment is identifiable and retrievable. It is helpful to include the name of the area and the date of the assessment to later be able to recall the assessment. Click “Proceed” if you are content with the name you have chosen.

You chose to start a new resilience assessment.

Following this you will be able to choose the scope of your assessment and answer the questions.

If you first want to learn more about the assessment, please have a look at the how to guide.

Name for the assessment:

Cancel
Proceed

Figure 17: The first step after choosing to start a new resilience assessment is to enter a name for your assessment.

You have now entered the process of the assessment, which initially looks like depicted in Figure 18. The assessment includes four steps ([chapter 4.2](#) – [chapter 4.6](#)) which are always visible at the top of the page. In the first step the **scope** is chosen, which is to say that you can decide on how detailed you want the assessment to be. The next step comprises the biggest part which is answering the **questions** of the questionnaire. In the following third step you receive **scores** on how well your historic area is equipped against possible changes to the environment, i.e., how resilient it is. The fourth and final step then consists of revisiting the weak spots the assessment has brought forth and formulating **plans** to amend and improve them.

The screenshot shows the ARCH RAD Resilience Assessment Dashboard. At the top, a progress bar indicates the current step in the assessment process. The steps are: 1. Choose scope, 2. Answer questions, 3. See scores, 4. Plan options, and 5. Exit assessment. The current step is 1, 'Choose scope'. Below the progress bar, there are two options for the assessment type: 'Perform a quick resilience assessment' (128 no. of questions) and 'Perform a detailed resilience assessment' (221 no. of questions). The 'Continue' button is visible. On the right side, there are links for 'User area', 'Historic area', 'FAQ', and 'Sign out'. The top right corner shows the language 'English' and a dropdown arrow.

You are working on the resilience assessment: 20220708_Brueggen

1 Choose scope 2 Answer questions 3 See scores 4 Plan options 5 Exit assessment

Please choose an assessment type:

☐ Perform a **quick** resilience assessment.
(in this assessment there is a total of 128 no. of questions)

☐ Perform a **detailed** resilience assessment.
(in this assessment there is a total of 221 no. of questions)

Currently you chose

0 questions.

Continue

You are working on the resilience assessment: RA_20220422_Büttelborn

1 Choose scope 2 Answer question 3 See scores 4 Plan options 5 Exit assessment

Figure 18: The resilience assessment includes four steps which are always visible at the top of the RAD page.

4.2. Choose the scope

You can start by choosing the scope of your assessment (Figure 19). There are two options to choose from. Either you select the quick resilience assessment which comprises a total of 128 questions, or you select the detailed resilience assessment which includes 221 questions. Depending on your personnel and time resources, one of the versions might be more suitable for you. The more questions are asked, the more stakeholders need to be involved and the more research needs to be done. But in any case, both assessments are processes that will take place over a longer period of time, from several days for the quick assessment to a few weeks or months for the detailed assessment.

Please choose an assessment type:

☐

Perform a **quick** resilience assessment

(in this assessment there is a total of **128** no. of questions)

☐


Perform a **detailed** resilience assessment

(in this assessment there is a total of **221** no. of questions)

Currently you chose

0 questions.

Figure 19: You start a resilience assessment by first deciding whether to do a quick or a detailed assessment.

After choosing the general scope there is the possibility of further modifying the assessment questionnaire to focus on the topics (called “essentials”) you are interested in (**Figure 20**). There are ten essentials to choose from and if you want to focus on a specific aspect of resilience of your area, it is possible to only activate those essentials. This in turn reduces the number of questions asked in the upcoming step. If you click on the information icon , a pop-up window opens with a description of each essential. Deselect essentials by clicking on them. They will appear in white, and the number of questions indicated above will have lowered accordingly. Press “continue” when you have finished selecting the scope of your assessment.

Please choose the essentials you are interested in:

☒

Organise for resilience

☒

Identify and use current and future risk scenarios

☒

Strengthen financial capacity for resilience

☒

Pursue resilient development

☐

Safeguard natural capital

☒

Strengthen institutional capacity for resilience

☒

Increase social capacity for resilience

☒

Increase resilience of supporting infrastructure and services

☒

Ensure effective disaster response

☒

Expedite recovery and build back better

Continue

Essential 04 : Pursue Resilient Development

This essential handles the incorporation of critical knowledge of the historic area and external influences into development planning for the historic area. Development planning should also always aim to improve the resilience of the historic area.

Key issues examined in this essential include:

- Identifying **tangible, intangible, and natural heritage features** as well as their condition;
- Considering potential **factors affecting the historic area**, such as socio-economic pressures and climate change impacts, in the development planning of the historic area;
- Ensuring the participatory **involvement of the local community** in development planning;
- Identifying and using **legal instruments, planning tools, and frameworks** for resilient development planning;
- Planning and implementing **development measures** in coordination with relevant stakeholders.

Figure 20: After having decided whether to do a quick or a detailed assessment, you can choose to focus on the topics you are interested in.

4.3. Navigate the assessment

Now the assessment begins. The essentials are grouped into subessentials, i.e., subtopics, that then each contain a number of questions (Figure 21).

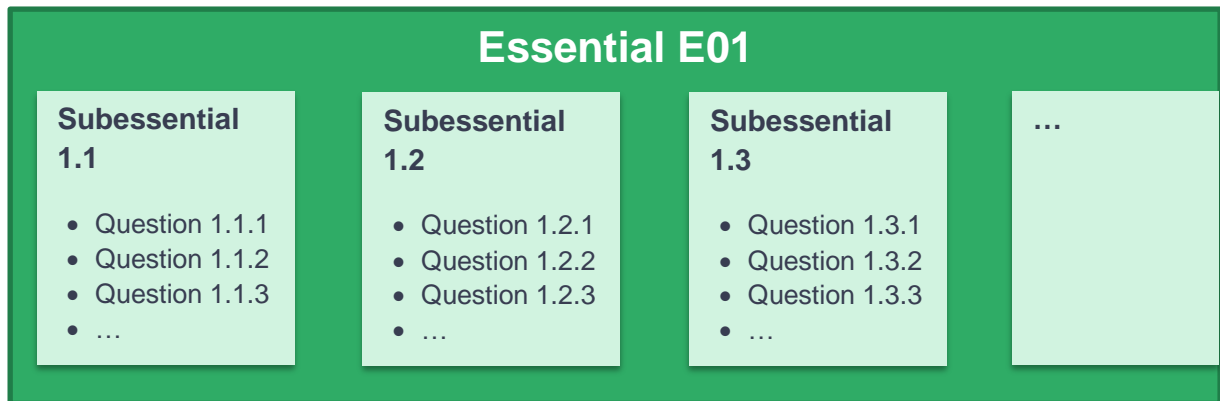


Figure 21: Each topic (= essential) of the questionnaire is grouped into subtopics (= subessentials).

To help navigate the essentials and their subessentials there is a navigational board at the top below the 4-step path (Figure 22).

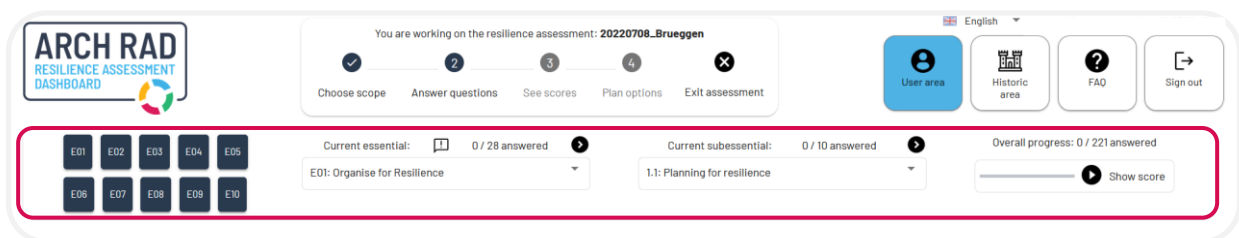


Figure 22: Navigational board at the top of the page below the 4-step path.

The blue tiles at the top left represent the essentials you have chosen to work on. By clicking on one of the tiles you are forwarded to the part of the questionnaire concerning this specific essential. When all questions of one essential are answered, the tile turns white, helping you visualize which essentials still need to be completed. Tiles are displayed in grey, if you have deselected them in the previous step while choosing the scope (Figure 23).



Figure 23: The blue tiles represent the essentials you have chosen to work on, the grey tiles represent essentials you have not chosen to work on and white tiles represent essentials of which all questions have been answered.

Another way of navigating through the essentials and their subessentials is by using the arrows and dropdown menus to the right of the tiles. The dropdown menus contain the names of the essentials (green in **Figure 24**) and subessentials (red in **Figure 24**) and let you jump to a selected area of the questionnaire by clicking on it. If you click on the information icon (i), a pop-up window opens with a description of the essential.



Figure 24: You can navigate through the essentials and subessentials by using the dropdown menu.

The arrows above the essentials and subessentials let you skip forward and backward either between the essentials (green in **Figure 25**) or subessentials (red in **Figure 25**). The text in between the arrows points out how many questions the essential (green) or subessential (red) encompasses and how many of them have been answered.

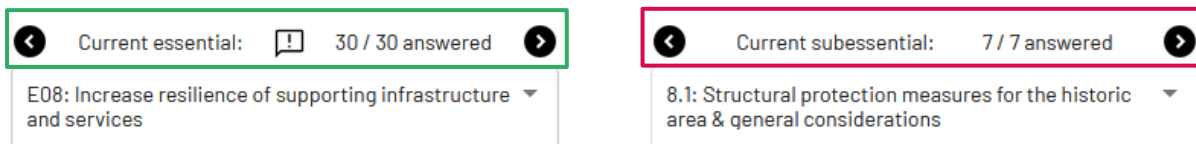


Figure 25: You can navigate through the essentials and subessentials by using the forward and backward arrows.

If you wish to move through the questionnaire in order, you can simply start with essential E01 and use the right arrow of the subessentials every time you have finished filling out a section of questions (Figure 26). This will move you through all essentials passing all subessentials in order.



Figure 26: You can move through the questionnaire in order by always using the right arrow of the current subessential.

If you are going through the questionnaire in order, you can simply answer all the questions of a subessential and navigate through the questionnaire by hitting the “Next subessential” button at the end of every page (Figure 27).

1.1.10 Sharing of resilience plans with external stakeholders specifically relevant to the local community

Are resilience plans inclusive of, and reviewed with relevant external stakeholders specifically relevant to the local community – and is there a focal person appointed to work with the community? ☐

☐ do not know ☐ does not apply Please insert any comments here:

0 - No processes exist to review or update plans with any external stakeholders.

1 - Review and update of resilience plans with relevant external stakeholders are only cursory and rudimentary. Very unlikely that important information will reach all those who need it.

2 - Review of resilience plans with external stakeholders from the local community is episodic. No focal person.

3 - Triggers are in place (e.g., a past catastrophic event) to initiate a review and update of resilience plans with external stakeholders from the local community, as needed. No focal person.

4 - Plans are reviewed regularly with most relevant stakeholders from the local community. A focal person is designated.

5 - Resilience plans are reviewed and updated regularly with all relevant stakeholders from the local community. A focal person is designated.

Next subessential

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no 820989.

Data privacy Imprint

Figure 27: You can move through the questionnaire in order by using the “Next subessential” button at the end of every page.

The progress bar to the right side of the navigational board indicates the progress you have made on the questionnaire by showing how many questions have been answered in total (Figure 28). By clicking on the progress bar after you have finished answering all questions, you are forwarded to the next step of the resilience assessment, and you are shown the scores ([chapter 4.5](#)).

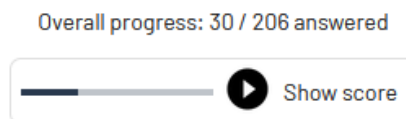


Figure 28: Progress bar to the right side of the navigational board which indicates how many questions have been answered.

4.4. Answer the questionnaire

Once you have chosen the scope of your assessment and know how to navigate the RAD, you can start answering the questions. The selected answers are saved so you can freely switch between the questions and the essentials and choose the order of answering by yourself.

The questions are single-choice questions where you choose out of six pre-determined answers the one that best describes the situation in your historic area. At times, you may feel that no answer fits your particular situation perfectly, but please choose the answer that comes closest to you. Choose your answer by clicking on it – your choice will be saved automatically (Figure 29).

9.1.2 Reach of warning

Will all people in the historic area be reached by the warnings and understand them? ☐ do not know ☐ does not apply

☐

- 0 - People will not be reached by warnings or it is extremely unlikely that this will happen.
- 1 - It is likely that a large number of people will not be reached.
- 2 - It is likely that a medium number of people will not be reached.
- 3 - It is likely that a small number of people will not be reached.**
- 4 - It is likely that a only a very limited number of people will not be reached.
- 5 - There is "reasonable confidence" that all people will be reached.

Figure 29: Questions are equipped with six answer options that you can choose from by clicking on the option that best fits your situation.

In addition to the pre-determined answers, each question is equipped with a comment box that can be used to note anything of interest (Figure 30). It is strongly recommended that you use the comment box to explain the reasons for the answer you gave, so that other persons working on the same assessment can understand it. The comment box is also helpful when repeating the assessment later. There is no save button, but answers will be saved automatically.

9.1.2 Reach of warning


Will all people in the historic area be reached by the warnings and understand them? ☐ do not know ☐ does not apply

☐


- 0 - People will not be reached by warnings or it is extremely unlikely that this will happen.
- 1 - It is likely that a large number of people will not be reached.
- 2 - It is likely that a medium number of people will not be reached.
- 3 - It is likely that a small number of people will not be reached.**
- 4 - It is likely that a only a very limited number of people will not be reached.
- 5 - There is "reasonable confidence" that all people will be reached.

Please insert any comments here:

Figure 30: Questions are equipped with a comment box that can be used to enter information for other people working on the assessment with you.

If you want to get additional information that helps you answer the question, click on the information button () that is placed behind each question (Figure 31). A section of text appears below the question explaining key terms or giving examples to further explain the content of the question. Additionally, hints are given on which stakeholders could be consulted to answer the question.

9.1.2 Reach of warning

Will all people in the historic area be reached by the warnings and understand them? 

Explanation

"People in the historic area" may include, for example, inhabitants of the historic area, people who live near the historic area, people who work within/near the historic area, visitors and tourists. To ensure that the warnings reach all occupants of the historic area, different types of channels can be installed or used in the historic area e.g. sirene systems, mobile warning apps, mobile text messages, mobile loudspeakers on emergency cars, etc.


Stakeholders that might help in answering the question

- Dept. Of Civil Protection
- local Civil protection Office
- schools
- citizen associations

Figure 31: Each question is equipped with a button that gives you further information, e.g., explanations on key terms, which help you answering the question.

If you are unable to answer a question, you have the option of ticking the “do not know”-checkbox. If on the other hand the question makes no sense for your historic area, you can tick the “does not apply”-checkbox instead. In both cases, these questions will be greyed out (Figure 32). Please note that ticking those two options will have different effects on your score. This will be explained in [chapter 4.5](#).

9.1.2 Reach of warning

Will all people in the historic area be reached by the warnings and understand them? 

☒ do not know ☐ does not apply

0 - People will not be reached by warnings or it is extremely unlikely that this will happen.

1 - It is likely that a large number of people will not be reached.

2 - It is likely that a medium number of people will not be reached.

3 - It is likely that a small number of people will not be reached.

4 - It is likely that a only a very limited number of people will not be reached.

5 - There is “reasonable confidence” that all people will be reached.

Figure 32: If you are unable to answer a question or the question does not apply to your historic area, you have the option of clicking “do not know” or “does not apply”.

When you have finished answering all questions, click on the progress bar on the right-hand side of the navigational board to check your scores (Figure 33).

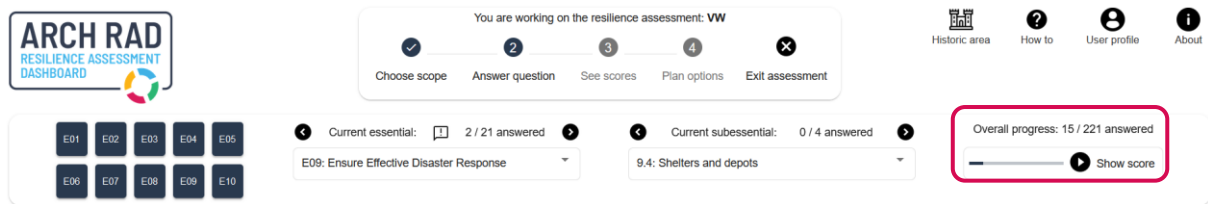


Figure 33: After having finished answering all questions, you can click on the progress bar on the right-hand side to check your scores.

If you have not answered all questions, you will be asked if you want to continue anyway (Figure 34). If you click “Yes”, you will be forwarded to the next step of the resilience assessment which is the presentation of the scores ([chapter 4.5](#)).

Confirm to navigate to the scoring page

You didn't answer all the questions. Are you sure that you want to continue?

Figure 34: If you have not answered all questions after clicking on the progress bar, you will be asked if you want to continue.

4.5. Check your scores

You will receive the results in the form of resilience scores, which are given as the total number of points achieved versus the number of achievable points (309 / 925). The overall resilience score (Overall resilience score) includes all points for all questions answered in the assessment (Figure 35). The score is calculated as follows: All questions have six answer options that are assigned values from 0 to 5. If you have answered 50 questions in total, your maximum score can be 300. Assuming that you were able to achieve a score of 170, your overall resilience score would be 170/300. The score is also visualised in a colour-graded guide which shows the results as a percentage. With a score of 170/300 you would be in the yellow range of 40-60 %.

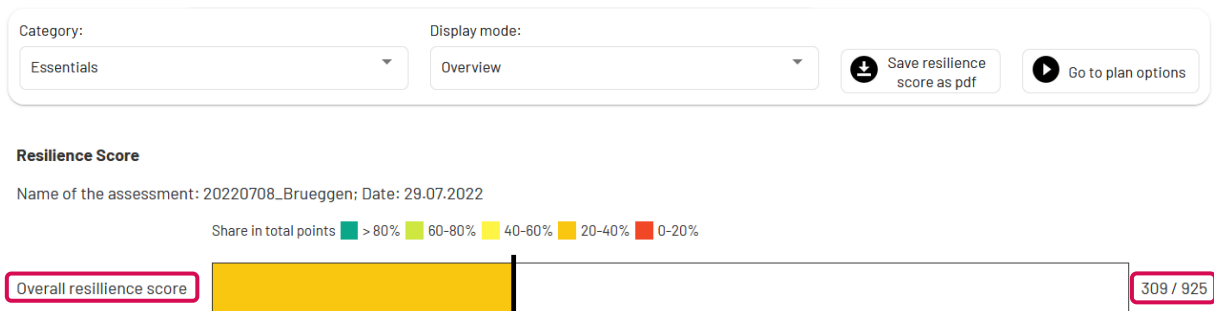


Figure 35: The results will be shown in the form of a resilience score which is the total number of points achieved versus the number of achievable points.

If you want to get more detailed information on your score, switch from the “overview” display mode to the “detailed” display mode (Figure 36).



Figure 36: The detailed display mode gives you more detailed information on your score.

In this view it is possible to obtain information about the exact distribution of points of the given answers (Figure 37). On the right-hand side you can see how many questions were answered with which score and how many questions were not answered at all or were answered with “do not know” or “does not apply”. The latter two pieces of information are also included in the colour-graded bars, with light grey representing the “do not know” answers and dark grey the “does not apply” answers. It must be noted that ticking the “does not apply”-checkbox will result in this question being completely excluded from the scoring, meaning the maximum achievable score will be reduced. Ticking the “do not know”-checkbox, on the other hand, will result in the question being given a score of 0, meaning this answer option will have a negative effect on the total score. The reason for this is that not knowing an answer offers potential to establish resilience whereas the question not being applicable does not.

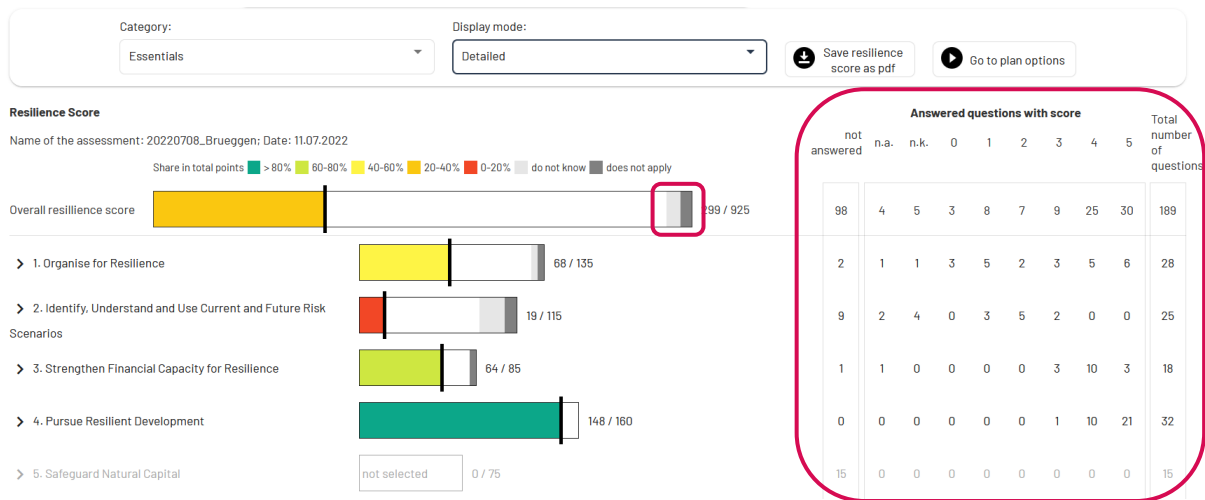


Figure 37: In the detailed view, you can obtain information about the exact distribution of points of the given answers.

You also have the possibility of checking out **scores in relation to a specific topic** that show you how well your historic area is equipped against hazards grouped by categories like the essentials, the resilience phases, or resilience dimensions like nature, economy, culture etc. (Figure 38). To display a topic's score, click on the dropdown menu under "Category" to choose from the topics. The detailed scoring allows you to identify shortcomings in specific areas and target them individually which is the basis for formulating the action plan. In **Figure 38** you see how well you are performing in the different essentials. By clicking on the arrows to the left of the subessential names (🔍), the individual scores for each subessential are revealed.

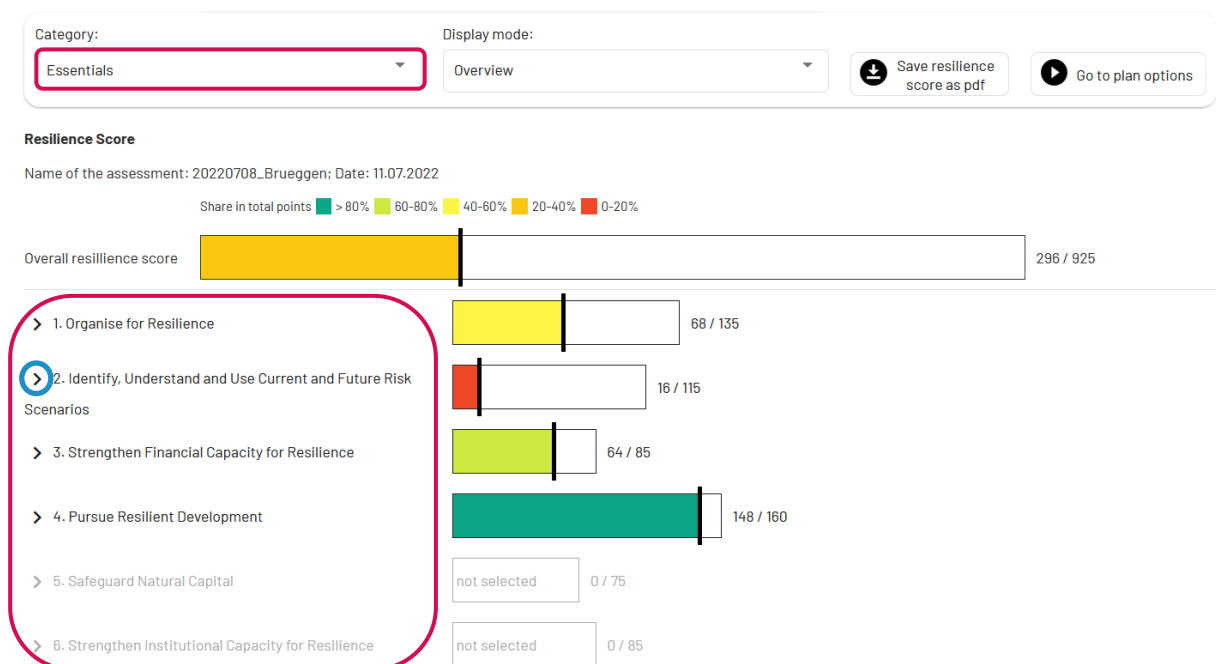


Figure 38: Scores can be shown in relation to a specific topic; they show, for example, how well you are performing in the different essentials.

To show scores for the individual resilience phases and resilience dimensions, all questions were checked for content overlap and assigned accordingly so that individual scores can be computed. Some questions could be matched with more than one topic. To prevent the resilience score from blowing up due to some questions being counted several times, the points are given as percentages rather than whole numbers as seen in **Figure 39**.

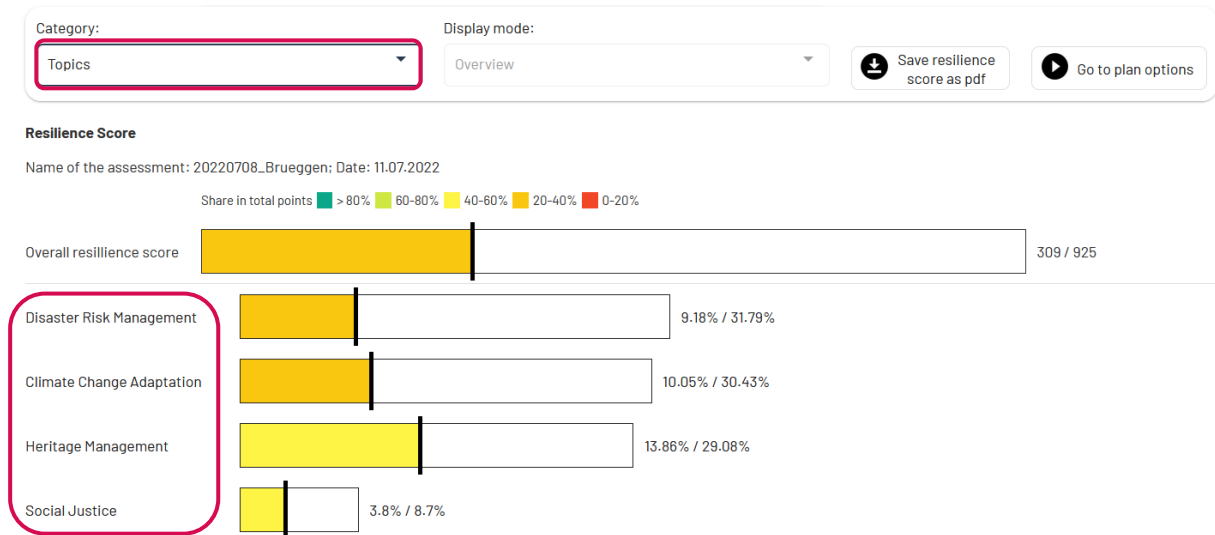


Figure 39: Scores can be shown in relation to a specific topic; they show, for example, how well you are performing in the different topics of resilience.

If you want your results in a format that can be mailed or printed, you can save it as a PDF (Figure 40). This way you can use it to support your communication with decision-makers. It is also a way to compare different results over time.

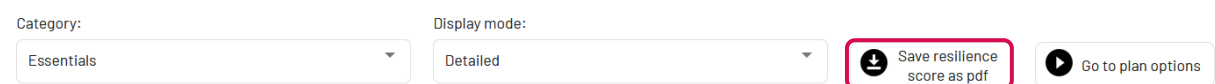


Figure 40: The results can be saved as a PDF.

4.6. Make an action plan

Once you have received and analysed your results, you will have identified prevailing weak spots in terms of resilience of your historic area. An optional next step in the RAD is to assign possible resilience-building measures and combine them into a resilience action plan. For this purpose, click on “Go to plan options” (Figure 41).

The screenshot shows the top navigation bar of the RAD interface. On the left, there is a 'Category:' dropdown menu with 'Essentials' selected. In the center, there is a 'Display mode:' dropdown menu with 'Detailed' selected. On the right, there are two buttons: 'Save resilience score as pdf' and 'Go to plan options'. The 'Go to plan options' button is highlighted with a red rectangular box.

Figure 41: Optionally, you can assign possible resilience-building measures after having received your results, by clicking on “Go to plan options”.

All questions are provided again to you and your given answers are colour-coded from red (low score) to yellow (medium score) to green (high score). In this way, you see immediately which questions and thus which topics require closer consideration of possible resilience-building measures. The box on the right can be used to enter your ideas for measures and again serves to share your ideas with other people working on the assessment (Figure 42).

The screenshot shows a question titled '1.1.1 Existence of strategies to maintain and improve resilience'. The question text is 'Does a (long-term) strategy / action plan exist to increase or maintain the resilience of the historic area?'. Below the question is a list of five options, each with a corresponding score: 0 - There is no strategy / action plan to increase or maintain the resilience of the historic area. 1 - There is no strategy / action plan yet, but plans are being developed to formulate one. 2 - There exists a strategy / action plan, but it is considered largely inadequate. 3 - There exists a strategy / action plan, but it is considered partly inadequate. 4 - There exists a strategy / action plan which, with exceptions, is considered adequate. 5 - There exists a strategy / action plan which is considered fully adequate. The option '1 - There is no strategy / action plan yet, but plans are being developed to formulate one.' is highlighted in red. To the right of the options is a text box with the heading 'You can formulate actions to increase your resilience here:' and a placeholder text 'e.g. name/title of action, description, responsible person, due date'. The text box is highlighted with a red rounded rectangular box.

Figure 42: After clicking on “Go to plan options”, you see your given answers in a colour-coded way and have the possibility to enter your ideas for resilience-building measures.

To help you find suitable resilience-building measures, you have the option of being guided to the [Resilience Measures Inventory \(RMI\)](#), a database of over 200 resilience-building measures developed as part of the ARCH Project (Figure 43). The RMI platform is equipped with a search engine that can, among other categories, be filtered by essentials and subessentials. This way you can directly look for measures that are helpful to improve in the essentials and subessentials where the assessment turned up a low score.

The screenshot shows the bottom navigation bar of the RAD interface. On the left, there is a 'Received overall score:' field with the value '309 / 945'. In the center, there are two dropdown menus: 'Current essential:' with 'E01: Organise for resilience' selected, and 'Current subessential:' with '1.1: Planning for resilience' selected. On the right, there are three buttons: 'Save resilience score as pdf', 'Open RMI', and 'Complete assessment'. The 'Open RMI' button is highlighted with a red rectangular box.

Figure 43: The button “Open RMI” guides to you the Resilience Measures Inventory by the ARCH project.

4.7. Finish the assessment

Once you are finished with the assessment you can click on the button “Complete assessment”. This will make the window in Figure 44 pop-up. By completing an assessment, you lock its contents – meaning the scope, answers, scores, and action plans – in place, so that no further changes can be made. This is important if you mean to compare a future assessment to a new assessment. The locking ensures that the original result is saved, and no accidental overrides or changes can be made.

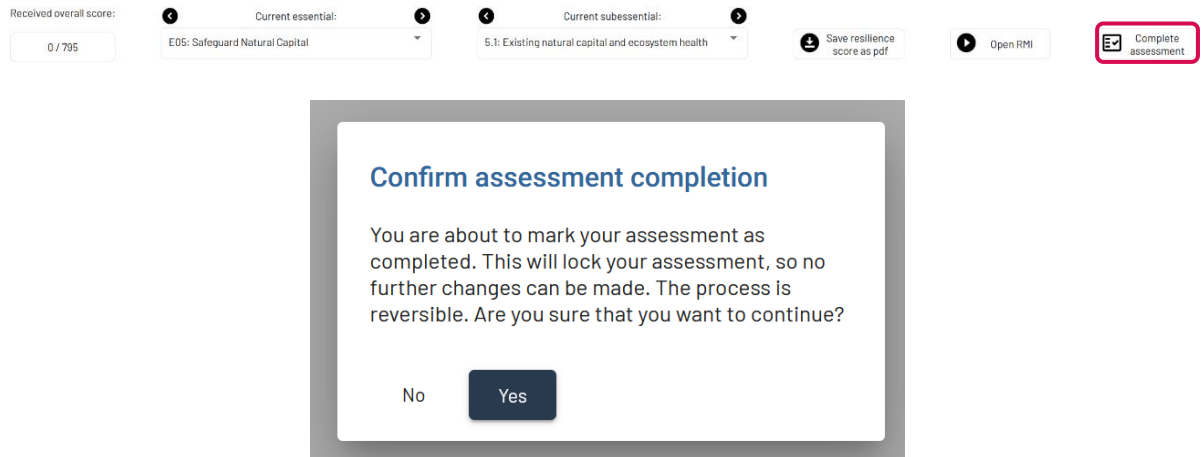


Figure 44: After having clicked “Complete assessment”, you must confirm this, as this will lock your assessment.

Directly after you lock the assessment, the process can be reversed (**Figure 45**).

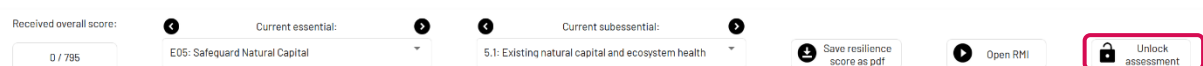


Figure 45: The locking of the assessment can be undone by clicking “Unlock assessment”.

Optionally, you can unlock the assessment through the user area or historic area (**Figure 46**). For the user area, access the resilience assessments page, choose and reopen a completed and locked assessment, click through the steps (scope, answers, scores, action plans) and, as before, you will see the “unlock assessment” button.

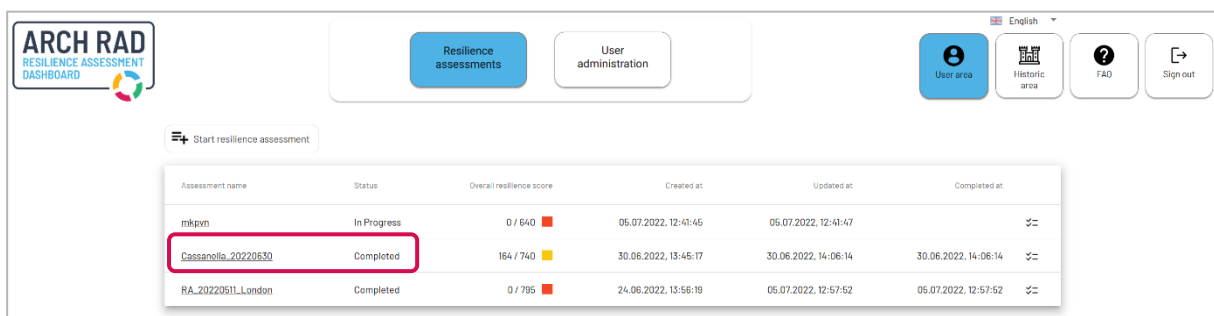

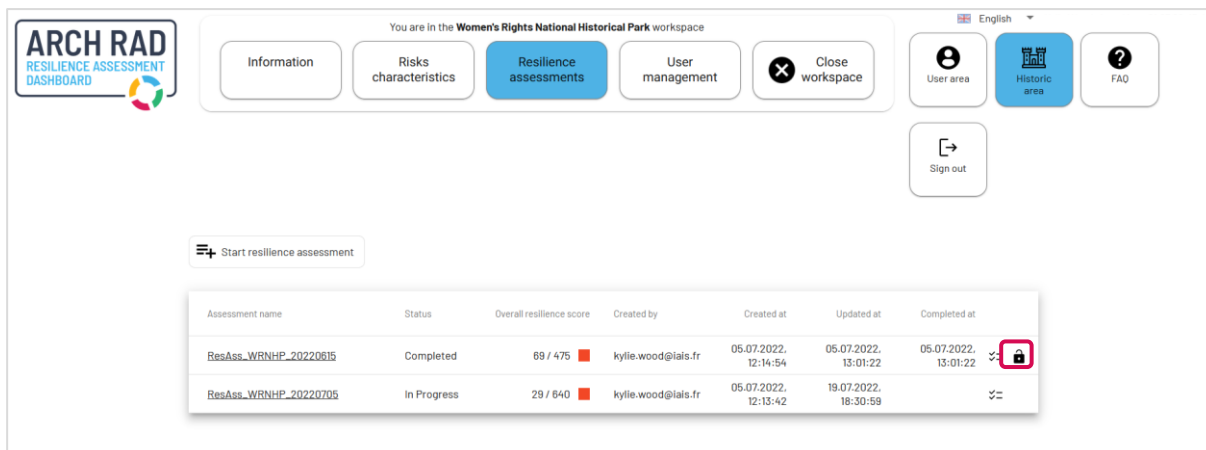


Figure 46: To unlock assessments in the user area, access the completed assessment.

For the historic area, likewise, enter the resilience assessments page. You can now use the -button to unlock completed assessments. To lock again, you will have to go through the assessment until you can complete on the last page. Please note that the lock in Figure 47 to unlock an assessment is only visible if you are the historic area workspace administrator.



You are in the **Women's Rights National Historical Park** workspace

English

Information Risks characteristics **Resilience assessments** User management Close workspace

User area **Historic area** FAQ

Sign out

Start resilience assessment



Assessment name	Status	Overall resilience score	Created by	Created at	Updated at	Completed at	
ResAss_WRNHP_20220615	Completed	69 / 475 	kylie.wood@iais.fr	05.07.2022, 12:14:54	05.07.2022, 13:01:22	05.07.2022, 13:01:22	
ResAss_WRNHP_20220705	In Progress	29 / 640 	kylie.wood@iais.fr	05.07.2022, 12:13:42	19.07.2022, 18:30:59		

Figure 47: Unlock button in the historic area workspace.

We hope you enjoy using the RAD!