ICARIA
Improving climate resilience of critical assets

www.icaria-project.eu

A. Lavasa & A. de la Cruz
(29th June 2023)

D6.8 Data Management Plan

Initial version

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No. 101093806. The publication reflects only the authors' views and the European Union is not liable for any use that may be made of the information contained therein.

D6.8 Data Management Plan

Initial version

Summary

This deliverable presents ICARIA's initial Data Management Plan. It defines the project's data management policy in accordance with EC guidance and the FAIR principles, as well as provisions for ethical, legal and security issues. The final plan will be delivered in month 34.

Deliverable number	Work package	
D6.8	WP6	
Deliverable lead beneficiary	**Deliverable author(s)**	**Contributor(s)**
DRAXIS	Artemis Lavasa (DRAXIS) Alex de la Cruz (AQUA)	Beniamino Russo (AQUA) Mattia Leone (UNINA) Rita Brito (LNEC) Marianne Bügelmayer (AIT) Denis Havlik (AIT) David Pacheco (CET) Barry Evans (UNEXE) Thanasis Sfestos (DMKTS) Angel Villanueva (AQUA)
Internal reviewer(s)	**External reviewer(s)**	
Denis Havlik (AIT)	Albert Chen (University of Exeter)	
Planned delivery date	**Actual delivery date**	
29/06/2023	30/06/2023	
Dissemination level	☑ PU = Public ☐ PP = Restricted to other programme participants ☐ RE = Restricted to a group specified by the consortium. Please specify: _____ ☐ CO = Confidential, only for members of the consortium	

Document history

Date	Version	Author	Comments
06/04/2023	0.1	Artemis Lavasa (DRAXIS)	Completed first draft of document
12/04/2023	0.2	Artemis Lavasa (DRAXIS), Alex de la Cruz (AQUA)	Revised first draft, additions
10/05/2023	0.3	All WPs leaders	Input from partners
29/05/2023	0.4	Artemis Lavasa (DRAXIS)	Final edits
16/06/2023	0.5	Denis Havlik (AIT)	Internal review
16/06/2023	0.6	Albert Chen (University of Exeter)	External review
29/06/2023	1.0	Artemis Lavasa (DRAXIS), Alex de la Cruz (AQUA)	Finalized document

Table of contents

List of Tables

List of Acronyms and Abbreviations

CS Case Study

CSF Case study facilitators

DoA Description of the Action

DMP Data Management Plan

DOI Digital Object Identifier

EOSC European Open Science Cloud

FAIR Findable, Accessible, Interoperable and Reusable

GDPR General Data Protection Regulation

HE Horizon Europe

KPI Key Performance Indicators

OA Open Access

OGC Open Geospatial Consortium

OS Open Science

PID Persistent identifier

RDM Research data management

SSO Specific Subobjectives

WP Work Package

Executive summary

The Data Management Plan (DMP) defines ICARIA's general approach to data management, and explains how data is collected, generated, reused and stored. In addition, it identifies specific requirements for accessibility, preservation, storage and open access publishing, such as embargo periods, the handling of personal information or restrictions due to other confidentiality issues.

This initial version of the DMP specifies the project's DMP policy addressing the guidelines on data management provided by the EC and the FAIR principles. It presents initial assumptions about the datasets expected to be generated by the ICARIA project, as well as the already-existing datasets which will be collected and (re)used by the project.

Plans for the security of data concerning critical infrastructures and ethics are also presented.

The final version (D6.9), due in M34, will update this initial version and will focus on post-project use of datasets.

This deliverable is the first result of T6.3.

1 Introduction

ICARIA promotes the use of a comprehensive asset-level modeling framework to achieve a better understanding of climate-related impacts caused by complex, compound and cascading disasters, and the suitable, sustainable and cost-effective adaptation solutions for risk reduction. Regional climate change can result in significant increases in the cost of maintenance and the potential for unplanned outages and failures – unless an effort is undertaken in making critical assets and infrastructures that are susceptible to climate change more resilient. ICARIA aims to investigate how future climate might affect life-cycle costs of these assets in the coming decades and to ensure that, where possible, investments in terms of adaptation measures are made up front to face these changes.

To achieve this aim, ICARIA has identified 7 Strategic Subobjectives (SSO), each one related to one or several work packages. The SSOs have been classified according to different categories: scientific, corresponding to research activities for advances beyond the state of the art; technological, suggesting and/or developing novel solutions, integrating state-of-the art and digital advances; societal, contributing to improved dialogue, awareness, cooperation and community engagement; and dissemination and exploitation, aimed at sharing ICARIA results to a broader audience and number of regions and communities to maximize project impact.

As these results can have varying forms, it should be noted that the purpose of this document is to address those SSOs which require collection, generation, or (re)use of data. Other SSOs will be covered through the project's dissemination and exploitation plans.

1.1 Scope

A Data Management Plan (DMP) ensures a high-level of data quality and accessibility for final users, through specifying data and metadata formats and protocols, data sharing, archiving and preservation, security, privacy, intellectual property, and General Data Protection Regulation (GDPR) issues. Project data and outputs generated will be managed following the "FAIR" approach (Findable, Accessible, Interoperable, Reusable) as specified in the Horizon Europe (HE) guidelines on Open Data.

The specific goals of the ICARIA DMP are defined as follows:

(a) define the project's data management policy, especially focusing on the topic of FAIR;

(b) describe the data being produced or reused during the project;

(c) identify and analyze ethical and legal issues, as well as issues relevant to security of critical infrastructures.

As DMPs are considered living documents, this draft plan reflects the current state of data management in the project at the six-month mark as well as best estimates for the future. The DMP will be updated with a final version towards the end of the project in M34 and will be kept regularly updated (see Methodology below).

2 Methodology

The EC has produced a guide (template)[1] to assist beneficiaries with the completion of the DMP, which provides a basis for describing the data produced or reused in a project. The template was updated for Horizon Europe projects and contains a set of questions as a guideline for beneficiaries to answer, addressing the following issues:

1. Data Summary
2. FAIR data
   - 2.1. Making data findable, including provisions for metadata
   - 2.2. Making data accessible
   - 2.3. Making data interoperable
   - 2.4. Increase data re-use
3. Allocation of resources
4. Data security
5. Ethical aspects
6. Other issues

Annex I presents the list of individual questions from the template which informed ICARIA's approach to each of the above issues.

More specifically, in order to address this guidance, ICARIA is providing:

(i) a data management policy (chapter 3), to define the project's overall approach to data management;

(ii) a description of the project's datasets (chapter 4), to identify the new (expected) datasets being generated by the project as well as already-existing datasets being collected and reused;

(iii) a plan for the security of data concerning critical infrastructures (chapter 5), as they have a very prominent role in the project and require special attention with regard to their protection;

(iv) a plan of action regarding ethics (chapter 6), to explicitly address the handling of personal data and any other ethical or legal issues.

[1] Horizon Europe Data Management Plan Template:
https://www.openaire.eu/images/Guides/HORIZON_EUROPE_Data-Management-Plan-Template.pdf

3 ICARIA data management policy

ICARIA partners firmly support Open Science as the best way to guarantee dissemination, exploitation and quality improvement of the research work being developed in the project. In this sense ICARIA will adopt and integrate Open Science practices in line with FAIR principles in all the activities of the project.

ICARIA's data management policy analyzes how each of the DMP issues identified in the methodology will be approached.

3.1 Data summary

ICARIA follows the approach of the KNOWING Project (GA 101056841) to include a data management statement as an annex to all ICARIA deliverables published after the present document (M6). The statement will address the following questions:

1) What existing data has been considered for reuse in preparation of this deliverable?
2) What data has been generated in preparation of this deliverable?
3) What input and output data types and formats were used in preparation of the deliverable?
4) How does the data generated or re-used contribute to the objectives of the project?
5) Data provenance
6) Data size
7) Conditions for re-use (e.g. open data, commercial license, special conditions such as commercial confidentiality or ethical constraints)
8) Potential utility of the data outside the project
9) Unique identifier (URI or DOI) for extended data information and access instructions

The template for this annex data management statement is provided as Annex II of this document.

Chapter 4 of this document provides summary tables of ICARIA's datasets, both those collected to be reused or new datasets to be generated by the project. These tables will be continuously updated.

3.2 FAIR data

3.2.1 Making data findable, including provisions for metadata

Persistent identifiers (PIDs) will be used for all published research outputs, including data, to ensure their findability. They will be globally unique and long-lasting references to digital objects (e.g. data, publications, other research outputs) or non-digital objects (e.g. researchers, research institutions, grants).

To enhance the findability of research outputs, and their potential reuse, standardized metadata frameworks will be adopted ensuring that data and other research outputs are accompanied by rich metadata which provides context.

As indicated in the GA, ISO/IEC 19128 (WMS services) and Open Geospatial Consortium (OGC) are relevant for geospatial data. Data can be stored in relational databases allowing for access using SQL standardized by ISO/IEC 9075. The XML standard (which is an application of SGML– ISO/IEC 88879 standard) will be considered in case of the data transmitted among system components. Finally, textual data can be stored using Unicode for data exchangeability (ISO/IEC 10646).

Zenodo will be used as the primary means of ensuring the findability of data and metadata. Zenodo is a Open Access general-purpose repository for all types of research results across disciplines. It has been developed in the context of the OpenAIRE program and it is offered by CERN. Publishing and preserving project results via Zenodo ensures ICARIA's public outputs compliance with FAIR guidelines as per Zenodo's documentation[2].

3.2.2 Making data accessible

Deliverables, publications, data, model results, as well as the ICARIA tools will be publicly available as open access/open data/open source. Early and open sharing of research will be encouraged to facilitate their discovery and reuse.

Openness will always respect IP rights and any embargo periods, as well as security, legal or ethical requirements. Such needs will be specified on a case-by-case basis through updates to this document and in particular will be identified by partners through the summary data tables (Chapter 4).

Zenodo will be the default choice for publishing and preserving ICARIA's results. Other disciplinary/institutional repositories or open infrastructures may also be used in conjunction with Zenodo, such as the Climate – ADAPT platform, the European Open Science Cloud (EOSC) portal and the Open Research Europe (ORE) publishing platform.

3.2.3 Making data interoperable

The project's (meta)data will follow specific nomenclatures and (open, when possible) formats to facilitate exchange and reuse. Any software designed will store and process data in standardized formats to ensure interoperability with other tools and applications.

Any proprietary/specialized formats which could affect the interoperability of the (meta)data produced will be disclosed by partners through the summary data tables (Chapter 4).

3.2.4 Increase data re-use

ICARIA is invested in ensuring the project's outcomes can be reproduced during and after the project. As such, it will provide the tools and documentation to clearly express how the methodologies are being developed and implemented in the case studies so they can be easily repurposed for other locations or applications.

[2] Zenodo FAIR Principles: https://about.zenodo.org/principles/

Sufficient descriptive metadata and documentation will be provided together with detailed provenance information. Possibly during the project - and certainly after the project's termination - the datasets will be made available for re-use through uploads to Zenodo and/or other suitable repositories with appropriate data usage licenses to allow for the widest reuse possible.

3.3 Other research outputs

Data managers will anticipate matters regarding the management of research outputs other than data produced or reused for the purposes of this project. Partners will be encouraged to treat these outputs in the same manner as data, applying FAIR principles, where applicable. More specifically, ICARIA research outputs such as models and software are intended to be made publicly available as open data/open source.

There is no foreseen production of physical outputs.

3.4 Allocation of resources

The use of Zenodo and of other open research infrastructures greatly diminishes the costs related to hosting and/or publishing project results. If certain tools/datasets/results are not to be published, the costs for hosting and maintaining them will be the responsibility of the partners who own said results. In this case, minimum preservation time will be 5 years after the project's end.

In order to pursue scientific publications on peer-reviewed indexed and open access journals, a total of EUR 19 400 split among partners is available to the project.

3.5 Data security

Each partner is responsible for managing the security of their data and tools. For the results published via Zenodo, the CERN Data Center provides sufficient security measures as well as assurances for the long-term preservation of the results[3].

During the lifetime of the project, a Google Drive shared folder will be the platform used by the consortium for sharing documents and information. Generally, Google Drive is considered a secure cloud storage service[4,5] and it is used regularly in EC projects. Only authorized project members will be given access to the shared folder. It will be provided and maintained by AQUATEC. This platform has an adequate level of digital security as it is protected by the corporate IT security service of AGBAR group. The access to this shared folder is limited to the ICARA project team.

Currently, it is not seen as necessary to set up "secure" data repositories. Hence, sensitive data should be managed by its respective owners/users and should never be uploaded to the shared project data space.

[3] Zenodo infrastructure (Security): https://about.zenodo.org/infrastructure/
[4] How Drive protects your privacy & keeps you in control: https://support.google.com/drive/answer/10375054?hl=en
[5] Learn how we help keep Google Drive secure: https://support.google.com/drive/answer/141702?sjid=7641787092192982677-EU&co=GENIE.Platform%3DDesktop&oco=1

In addition, Chapter 5 below describes ICARIA's plan for the handling of data about critical infrastructures.

3.6 Ethics

ICARIA tools and data will provide a cloud-based environment. Any database containing data deemed to be sensitive will be encrypted using the current industry standard. Confidentiality levels as the ones provided by the EC will ensure the full compliance with the GDPR. Personal data will be processed in full accordance with GDPR 2016/679.

Chapter 6 expands on ICARIA's plan regarding ethics, including the handling of personal data and other legal issues.

3.7 Other issues

Partners will be encouraged to disclose the use of any national/funder/sectorial/departmental procedures for data management.

4 DMP components in ICARIA

ICARIA data can refer to data generated by the partners and the methodologies/tools developed during the project (primary origin data) or to already-existing data collected from various sources to be used in the project to achieve new objectives (secondary origin data).

Taking into consideration HE's DMP template questions (Annex I), and as a supplement to the project's data management policy, the tables below present initial assumptions about the datasets expected to be generated by the ICARIA project (Table 1), as well as the already-existing datasets which will be collected and (re)used by the project (Table 2).

It should be noted that this list is based on current information (up to M6) and will be extended and/or corrected during the project's lifetime as needed.

Table 1. List of expected datasets generated by the ICARIA project.

Result description	**WP**	**Result owner(s)**	**Due date**	**Expected format** *(including proprietary formats that could affect the interoperability of the (meta)data produced)*	**End users/data utility** *(data utility: to whom might this data be useful outside/within the project?)*	**OA conditions** *(indicate embargoes, legal or security matters, ethics, or anything relevant to the accessibility or sharing of the resulting (meta)data.)*
Climate downscaled projections, decadal and seasonal simulations	WP1	FIC and AIT	M12	Ascii and netcdf files with climate data per variable, model, scenario, etc.	Case Study Facilitators that will use this information as inputs for their hazard models. Also model owners or other climate researchers that will use this information as inputs for their research.	Not foreseen

Result description	WP	Result owner(s)	Due date	Expected format *(including proprietary formats that could affect the interoperability of the (meta)data produced)*	End users/data utility *(data utility: to whom might this data be useful outside/within the project?)*	OA conditions *(indicate embargoes, legal or security matters, ethics, or anything relevant to the accessibility or sharing of the resulting (meta)data.)*
Statistical return period of extreme events	WP1	FIC and AIT	M12	Ascii files with climate data per variable, model, scenario, etc.	Case Study Facilitators that will use this information as inputs for their hazard models. Also model owners or other climate researchers that will use this information as inputs for their research.	Not foreseen
Statistical analyses of the probability of joint occurrence of combined events	WP2	FIC, AIT and AQUATEC	M12	Ascii files with climate data per variable, model, scenario, etc.	Case Study Facilitators that will use this information as inputs for their hazard models. Also model owners or other climate researchers that will use this information as inputs for their research.	Not foreseen
Hazard maps for the different climatic hazards considered in the Barcelona Region CS	WP2	AQUATEC	M18	Map (GIS based) showing the hazard distribution on the case study area for several scenarios and different climate hazards (flood maps, coastal flood maps, heat wave maps, forest fire risk maps). GIS data could be in either raster or vector formats.	Case Study Facilitators that will use this information as inputs for their risk assessment. Also model owners or other climate researchers that will use this information as inputs for their research .	Not foreseen

Result description	WP	Result owner(s)	Due date	Expected format *(including proprietary formats that could affect the interoperability of the (meta)data produced)*	End users/data utility *(data utility: to whom might this data be useful outside/within the project?)*	OA conditions *(indicate embargoes, legal or security matters, ethics, or anything relevant to the accessibility or sharing of the resulting (meta)data.)*
Hazard maps for the different climatic hazards considered in the South Aegean Region CS	WP2	DEMOKRITOS	M18	GIS data showing the hazard distribution on the case study area for several scenarios and different climate hazards (Trial: drought, heatwave, forest fire, wind storms. Mini Trial: storm surge, floods). GIS data could be in either raster or vector formats.	Case Study Facilitators that will use this information as inputs for their risk assessment. Also model owners or other climate researchers that will use this information as inputs for their research. Outputs used in WP3 for impact assessment for varying scenarios.	Not foreseen
Hazard maps for the different climatic hazards considered in the Salzburg Region CS	WP2	AIT	M18	GIS (or map based) data showing the hazard distribution on the case study area for several scenarios and different climate hazards (Trial: storm surge, floods. Mini Trial: heatwave, wind, storms). GIS data could be in either raster or vector formats.	Case Study Facilitators that will use this information as inputs for their risk assessment. Also model owners or other climate researchers that will use this information as inputs for their research. Outputs used in WP3 for impact assessment for varying scenarios.	Not foreseen

Result description	WP	Result owner(s)	Due date	Expected format *(including proprietary formats that could affect the interoperability of the (meta)data produced)*	End users/data utility *(data utility: to whom might this data be useful outside/within the project?)*	OA conditions *(indicate embargoes, legal or security matters, ethics, or anything relevant to the accessibility or sharing of the resulting (meta)data.)*
Drought and water quality analysis	WP2	AQUATEC	M18	Excel sheets presenting the water deficits for the future scenarios	Case Study Facilitators, water companies and the Catalan Water Agency	Not foreseen
Portfolio of adaptation solutions	WP3	CETAQUA	M18	Digital platform containing a repository of climate change adaptation measures, covering all hazards and areas in the project's scope. Written report describing potential climate change adaptation measures for the three CS.	Local authorities, asset/service managers, urban planners, decision/policy makers, other researchers	Not foreseen
Decision Support System	WP3	DRAXIS	M33	Web-based platform and interface, including maps and other GIS functionality, to compare and prioritize adaptation solutions and scenarios. The DSS integrates	Local authorities, asset/service managers, urban planners, decision/policy makers, other researchers	Not foreseen

Result description	WP	Result owner(s)	Due date	Expected format *(including proprietary formats that could affect the interoperability of the (meta)data produced)*	End users/data utility *(data utility: to whom might this data be useful outside/within the project?)*	OA conditions *(indicate embargoes, legal or security matters, ethics, or anything relevant to the accessibility or sharing of the resulting (meta)data.)*
				existing tools and methods from ICARIA results.		
Resilience assessment of each case study	WP3	Case study owners	M33	Web-based platform to assess resilience of city, services and assets. PDF report from ICARIA RAF App, excel sheet report from ICARIA RAT and web-based interface output from the decision support system for the three CS.	Local authorities, asset/service managers, urban planners, decision/policy makers, other researchers	Not foreseen
Quantification of direct and indirect tangible damage caused by all climate hazards on all critical assets considered in the project scope for each CS region	WP3 and WP4	AQUATEC and CETAQUA	M30	Excel sheets indicating total economic damages	Critical assets operators, risk owners, local authorities and other researchers	Not foreseen

Result description	WP	Result owner(s)	Due date	Expected format *(including proprietary formats that could affect the interoperability of the (meta)data produced)*	End users/data utility *(data utility: to whom might this data be useful outside/within the project?)*	OA conditions *(indicate embargoes, legal or security matters, ethics, or anything relevant to the accessibility or sharing of the resulting (meta)data.)*
Impact assessment of multiple hazards on the full set of critical assets considered each CS region	WP4	AQUATEC, CETAQUA, AMB, IREC, and AB	M30	Maps and ascii information presenting the distribution of affected assets	Local authorities (e.g. city councils, civil protection department, health authorities), insurance companies, risk owners, facility operators and other researchers	Not foreseen
Exploitation and sustainability analysis for the project	WP4	All project partners, DRAXIS	M33	Excel sheets containing input from partners on IP issues, exploitation pathways, market insights and risks, etc.	Result owners within the project. Depending on the result (commercial or not) other projects, public authorities, researchers, decision/policy makers.	Not foreseen
Assessment of the trials for each case study	WP4	Case studies	M30	Combination of measurements (e.g. time necessary to perform a task), surveys and interviews with trial participants Written report on individual assessments of the trials and a project-level summary of results.	Case study facilitators, tool developers	Not foreseen

Table 2. List of input datasets used in the ICARIA project.

WP	Data	Data origin	Format
WP1	Meteorological historical data of climatic parameters data series (temperature, humidity, rainfall...) and historic record of extreme and combined events	European, National and Regional meteorological agencies, sea port operators	Datasets (txt, csv, access to database)
	Future climate scenarios	Public data from IPCC	Public reports
WP2	GIS information on geographical morphology and characteristics of the studied data	Public datasets	Various
WP2 and WP3	Location, characteristics and (if needed) structural information of the critical assets considered in the study	Public datasets, data provided by the assets operators, consortium know-how, results form previous research projects	Various
WP3	Datasets of quantification of impacts, e.g. outputs from WP1 and WP2	Public information coming from previous projects	Hazard maps, numerical results from modelling
WP3	Performance indicators of the assets that allow to assess scenarios under different hazards	Public datasets of urban and natural areas containing figures that allow quantifying impacts (e.g. municipal statistics, economic performance reports, sectoral economic reports)	Datasets with various quantitative variables

WP3	List of adaptation measures and the relevant details associated to them (costs, impact reduction)	Public information coming from previous projects	Datasets with various quantitative variables

5 Data security management of critical assets

As described in the project proposal, ICARIA aims to perform risk analysis of different climate hazards at asset level. Some of the assets within the scope of the study can be considered Critical Infrastructures (CI) according to the EU Directive 2008/114/EC (European Commission, 2008). Consequently, since the work to be done in ICARIA will involve hazard, vulnerability and risk assessment for some CI (and other assets not considered as critical), specific measures to ensure adequate and safe use of data might be needed.

However, at this early stage of the project it is not possible to compile an exhaustive list of the individual CI that will be considered in all risk assessment scenarios. It is not yet known at which level of detail some of the sectoral models will be considered and so, there is no clear knowledge whether their CI will be included or not.

Nevertheless, the following bullet points indicate general considerations to bear in mind when working with data regarding CI and when preparing reports mentioning data, methods or results involving these infrastructures.

- Prior to using any kind of data related to a CI, the consortium partner has to inform and reach an agreement with the data facilitator (e.g. a critical infrastructure manager) regarding its use, storage and dissemination within the consortium and in the related deliverables.
- If required, non-disclosure agreements could be signed between the data facilitator and the consortium.
- CI information should not be stored in public shared spaces
- All data regarding CI must be used in accordance with the mentioned agreements.
- Confidential data of any kind must not be included in the project deliverables in any way (e.g. locations of CIs, specification about the vulnerability of individual assets, economic value of individual assets or damages).
- The consortium member who defines the data usage agreement with the data owner is ultimately responsible for its adequate use.

It should be considered that the DMP is a living document that will be updated during the project's lifetime. Should security issues arise in terms of the management of CI data which have not been foreseen in this document, specific solutions and measures will be defined for each case by the corresponding data user (consortium partner) in agreement with the data owner and the project coordinator.

Given the considerations above, at this stage of the project it is not considered necessary to change the classification of any deliverable from public to sensitive. Hence, according to the GA, all deliverables remain public except for the ones belonging to WP7.

6 Ethical and legal aspects

According to the DoA of ICARIA's Grant Agreement, a work package has been defined to handle ethical issues that may arise along the project: WP7 Ethics Management. This WP is specifically dedicated to ensuring that all personal data handled in the project is managed in accordance with GDPR regulations.

Nevertheless, in order to identify potential ethical issues related to any aspect of data management across the project, the below have been classified as data which might require special attention:

1. **Professional contact data of the project participants:** collected in order to enable efficient communication within the ICARIA consortium. The professional contact data of all project participants (a total of 70 people as of June 2023) has been gathered. This information includes the person's name, company and corporate email. This information will be used to generate mailing lists that will be distributed within the consortium.

2. **Financial reporting data:** every 6 months the project coordination team will require all members of the consortium to present a financial report of the last semester. The report will include a statement of both the manpower dedicated to the project and the eligible expenses incurred during that period. This information will be reviewed by the project coordinator in order to assess the compliance with the GA and the project budget, and later will be presented to the EC. The statements received by the coordinator will have a predefined format and will not include sensitive information such as timesheets, invoices, salaries etc. Nevertheless, according to the GA, audits to analyze the expenses reported by a consortium member could be carried out by the EC. In this case, the project coordinator might need to manage a request of documentation between the EC and a specific partner to justify the expenses incurred (e.g. time sheets, invoices, payment certificates).

3. **Critical assets information:** as presented in Chapter 5, the project involves the use of data regarding assets that are classified as critical infrastructure. This will involve the use of potentially sensitive data which will be managed in a safe manner and according to a non-disclosure agreement with the data owner. At this stage of the project no ethical concerns are identified in this sense.

4. **Communities of Practitioners (CoP):** according to the project proposal, each case study will involve third parties who will represent stakeholders relevant to the project's development. They will be involved in regular workshops regarding the case study risk assessment. To organize these events, professional contact data will be gathered similarly to the project participants. On a general basis, this will be the only kind of data provided by the third parties involved in the CoP. Nevertheless, in some cases a stakeholder might be requested to share specific information relevant to the project. Following the guidelines defined in Chapter 5, prior to the information exchange the CoP coordinator (the Case Study Facilitator) will present a signed agreement with the stakeholder that will state the characteristics of the data share, how it will be used and who is allowed to access it (and under which conditions). Prior to any interview, survey or other participatory processes where data is generated, all participants involved will be informed about the usage of this information and a consent form will be provided for signature.

5. **Data gathered at trials**: Trial guidance methodology (e.g. Hall et al., 2022), which is a basis for ICARIA testing and validation, explicitly foresees collecting of data in forms of surveys and interviews with trial participants. These participants will include both project participants and CoP members and serve the purpose of assessing the trial results. This data will reflect professional opinions of participants and is likely to be traceable back to individual participants. After the trial ends, this data will be anonymised and processed to assess the trial results, and the results published as part of the trial assessment data. Original data will be stored securely by trial organizers for an adequate period to allow auditing of the trial findings and will not be made public.

Additional types of data not foreseen at this stage might be handled during the project. If needed, the project coordinator will assess the need to define specific procedures to manage sensitive data in coordination with WP7 and the Ethics Advisor.

Table 3 summarizes the main kinds of data that will be managed which are relevant to the topic of ethics, potential ethical issues to consider and specific management considerations. The contents of the table have been defined in cooperation with the legal compliance department of the coordinator, AQUATEC. This department has assessed if any ethical issue could arise in terms of data privacy and the GDPR.

If an ethical or GDPR conflict not foreseen arises in the future, the project coordinator, together with AQUATEC's legal compliance department, will take the necessary measures to ensure adequate management of the issue.

Table 3. Summary of main data types with potential ethical issues

Kind of data	Potential ethical issues	Management considerations
Professional contact data of the project participants	Not foreseen	Professional contact data will only be used to enable the communication within the project consortium. This data will only be distributed within the project consortium.
Financial reporting data	Not foreseen on a general basis Only in case of an audit requesting additional information from a specific partner	The reporting document indicating the expenses incurred is only accessible by the project coordination team and the financial responsible of the corresponding partner institution.
CoP	Not foreseen	Professional contact data will only be used to enable the communication between the project consortium and the third parties involved in the CoP.
Critical assets information	Not foreseen	Not foreseen

Kind of data	Potential ethical issues	Management considerations
Trial assessments	Unlikely, but all trial questionnaires and interviews will need to be assessed for potential issues	Questionnaires and interviews will be anonymised and processed, with the goal of objectively assessing the trial results. In this process, the traceability to individual trial participants should be lost as individual surveys and interviews are merged and processed. Original responses to questions and interviews will be kept securely by trial organizers for an adequate period and destroyed afterwards, whereas processed results will be published as part of the trial assessments.

7 Conclusions

This deliverable presents ICARIA's Data Management Plan at the six-month mark. The plan comprises the project's data management policy, tables summarizing the data being produced or reused during the project's lifetime, and the procedures being followed with regard to the management of data about critical infrastructures, as well any ethical issues.

This DMP will be updated with a final version in M34. It will be kept regularly updated through the data management Annexes which will be included in all future deliverables.

References

EU Grants. (2021). *Horizon Europe Data Management Plan Template*. OpenAire. Retrieved March 27, 2023, from https://www.openaire.eu/images/Guides/HORIZON_EUROPE_Data-Management-Plan-Template.pdf

European Commission (2008). *Council Directive 2008/114/EC of 8 December 2008 on the identification and designation of European critical infrastructures and the assessment of the need to improve their protection*. Official Journal of the European Union.

Hall, J., Meijer, S., & Kendall, R. (2022). *Deliverable 5.4 Field Trial Design*. RESILOC Project.

Annex I: Horizon Europe DMP template questions

1. Data Summary

- Will you re-use any existing data and what will you re-use it for? State the reasons if re-use of any existing data has been considered but discarded.
- What types and formats of data will the project generate or re-use?
- What is the purpose of the data generation or re-use and its relation to the objectives of the project?
- What is the expected size of the data that you intend to generate or re-use?
- What is the origin/provenance of the data, either generated or re-used?
- To whom might your data be useful ('data utility'), outside your project?

2. FAIR data

2.1. Making data findable, including provisions for metadata

- Will data be identified by a persistent identifier?
- Will rich metadata be provided to allow discovery? What metadata will be created? What disciplinary or general standards will be followed? In case metadata standards do not exist in your discipline, please outline what type of metadata will be created and how.
- Will search keywords be provided in the metadata to optimize the possibility for discovery and then potential re-use?
- Will metadata be offered in such a way that it can be harvested and indexed?

2.2. Making data accessible

Repository:
- Will the data be deposited in a trusted repository?
- Have you explored appropriate arrangements with the identified repository where your data will be deposited?
- Does the repository ensure that the data is assigned an identifier? Will the repository resolve the identifier to a digital object?

Data:
- Will all data be made openly available? If certain datasets cannot be shared (or need to be shared under restricted access conditions), explain why, clearly separating legal and contractual reasons from intentional restrictions. Note that in multi-beneficiary projects it is also possible for specific beneficiaries to keep their data closed if opening their data goes against their legitimate interests or other constraints as per the Grant Agreement.
- If an embargo is applied to give time to publish or seek protection of the intellectual property (e.g. patents), specify why and how long this will apply, bearing in mind that research data should be made available as soon as possible.
- Will the data be accessible through a free and standardized access protocol?
- If there are restrictions on use, how will access be provided to the data, both during and after the end of the project?
- How will the identity of the person accessing the data be ascertained?

- Is there a need for a data access committee (e.g. to evaluate/approve access requests to personal/sensitive data)?

Metadata:

- Will metadata be made openly available and licenced under a public domain dedication CC0, as per the Grant Agreement? If not, please clarify why. Will metadata contain information to enable the user to access the data?
- How long will the data remain available and findable? Will metadata be guaranteed to remain available after data is no longer available?
- Will documentation or reference about any software needed to access or read the data be included? Will it be possible to include the relevant software (e.g. in open source code)?

2.3. Making data interoperable

- What data and metadata vocabularies, standards, formats or methodologies will you follow to make your data interoperable to allow data exchange and re-use within and across disciplines? Will you follow community-endorsed interoperability best practices? Which ones?
- In case it is unavoidable that you use uncommon or generate project specific ontologies or vocabularies, will you provide mappings to more commonly used ontologies? Will you openly publish the generated ontologies or vocabularies to allow reusing, refining or extending them?
- Will your data include qualified references[1] to other data (e.g. other data from your project, or datasets from previous research)?

2.4. Increase data re-use

- How will you provide documentation needed to validate data analysis and facilitate data re-use (e.g. readme files with information on methodology, codebooks, data cleaning, analyses, variable definitions, units of measurement, etc.)?
- Will your data be made freely available in the public domain to permit the widest re-use possible? - Will your data be licensed using standard reuse licenses, in line with the obligations set out in the Grant Agreement?
- Will the data produced in the project be useable by third parties, in particular after the end of the project?
- Will the provenance of the data be thoroughly documented using the appropriate standards?
- Describe all relevant data quality assurance processes.

3. Other research outputs

- In addition to the management of data, beneficiaries should also consider and plan for the management of other research outputs that may be generated or re-used throughout their projects. Such outputs can be either digital (e.g. software, workflows, protocols, models, etc.) or physical (e.g. new materials, antibodies, reagents, samples, etc.).
- Beneficiaries should consider which of the questions pertaining to FAIR data above, can apply to the management of other research outputs, and should strive to provide sufficient detail on how their research outputs will be managed and shared, or made available for re-use, in line with the FAIR principles.

4. Allocation of resources

- What will the costs be for making data or other research outputs FAIR in your project (e.g. direct and indirect costs related to storage, archiving, re-use, security, etc.) ?
- How will these be covered? Note that costs related to research data/output management are eligible as part of the Horizon Europe grant (if compliant with the Grant Agreement conditions)
- Who will be responsible for data management in your project?
- How will long term preservation be ensured? Discuss the necessary resources to accomplish this (costs and potential value, who decides and how, what data will be kept and for how long)?

5. Data security

- What provisions are or will be in place for data security (including data recovery as well as secure storage/archiving and transfer of sensitive data)?
- Will the data be safely stored in trusted repositories for long term preservation and curation?

6. Ethics

- Are there, or could there be, any ethics or legal issues that can have an impact on data sharing? These can also be discussed in the context of the ethics review. If relevant, include references to ethics deliverables and ethics chapter in the Description of the Action (DoA).
- Will informed consent for data sharing and long term preservation be included in questionnaires dealing with personal data?

7. Other issues

- Do you, or will you, make use of other national/funder/sectorial/departmental procedures for data management? If yes, which ones (please list and briefly describe them)?

Annex II: Table templates for the "Data Management Statement" Annexes

Table II.1. Data used in preparation of ICARIA Deliverable #.#

Dataset name	Format	Size	Owner and re-use conditions	Potential Utility within and outside ICARIA	Unique ID

Table II.2. Data produced in preparation of ICARIA Deliverable #.#

Dataset name	Format	Size	Owner and re-use conditions	Potential Utility within and outside ICARIA	Unique ID

ICARIA
Improving climate resilience of critical assets

More info: **www.icaria-project.eu**

CETAQUA WATER TECHNOLOGY CENTRE
AQUATEC
Aigües de Barcelona
AIT AUSTRIAN INSTITUTE OF TECHNOLOGY
AMB Àrea Metropolitana de Barcelona
iti CENTRE FOR RESEARCH & TECHNOLOGY - HELLAS Information Technologies Institute
DEMOKRITOS
DRAXIS ENVIRONMENTAL TECHNOLOGIES
fic
IREC
LNEC LABORATÓRIO NACIONAL DE ENGENHARIA CIVIL
aegean islands Region of South Aegean
University of Exeter
CENTRO STUDI PLINIVS
Verbund

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No. 101093806. The publication reflects only the authors' views and the European Union is not liable for any use that may be made of the information contained therein.