D1.2

DATA MANAGEMENT PLAN

Revision **version 1.0**

Work package	WP1
Task	T1.5
Due date	31-03-2024
Submission date	31-03-2024
Deliverable lead	FORTH
Version	v1.0
Authors	George Fouskas (FORTH), Magda Spella (FORTH)
Reviewers	Spyros Yannopoulos (FORTH) Athanasios Masouras (PLE) Despoina Batsouli (ADA) Philippe Basset (UGE) Michael Schneider (Born) Tullio Scopigno (URM) Andrej Campa (ComS) Apurba Ray (DLR) Daniele Spinelli (NTT) Mona Marill (AUS) Konstantinos Vavekis (EUG)

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

Abstract

The Data Management Plan (DMP) outlines what data the project will generate, how it will be managed, stored, and shared, and whether and how it will be exploited or made accessible for verification and re-use. The plan also details the responsibilities of those involved in the project regarding data management. The DMP is a living document that will be modified and refined throughout the life cycle of the GRAPHERGIA research project.

Keywords

Data management, Data repository, FAIR data, Data reuse, Data preservation, Open Science, Open Access

Document revision history

Version	Date	Description of change	Contributor(s)
v0.1	15-03-2024	Questionnaire on expected Research Outputs	George Fouskas (FORTH), Magda Spella (FORTH)
v0.2	22-03-2024	Responses in questionnaire received by consortium partners	All
v0.3	28-03-2024	1st version of deliverable	George Fouskas (FORTH), Magda Spella (FORTH)
v0.4	30-03-2024	Internal review	Spyros Yannopoulos (FORTH) Athanasios Masouras (PLE) Despoina Batsouli (ADA) Philippe Basset (UGE) Michael Schneider (BORN) Tullio Scopigno (URM) Andrej Čampa (ComS) Apurba Ray (DLR) Daniele Spinelli (NTT) Mona Marill (AUS) Konstantinos Vavekis (EUGL)
v1.0	31-03-2024	Final version	Magda Spella (FORTH)

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

Disclaimer

Copyright notice

Project co-funded by the European Commission in the Horizon Europe Programme

Nature of the deliverable		**R**
Dissemination level		
PU	Public, fully open. e.g., website	✔
CL	Classified information as referred to in Commission Decision 2001/844/EC	
CO	Confidential to GRAPHERGIA project and Commission Services	

* **Deliverable types:**
R: document, report (excluding periodic and final reports).
DEM: demonstrator, pilot, prototype, plan designs.
DEC: websites, patent filings, press and media actions, videos, etc.
OTHER: software, technical diagrams, etc.

Table of contents

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

List of figures

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

List of tables

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

Abbreviations

DMP	Data Management Plan	**HEU**	Horizon Europe
FAIR	Findable, Accessible, Interoperable, Reusable	**CSV**	Comma-Separated Values
EC	European Commission	**XLS/XLSX**	Microsoft Excel
WP	Work Package	**ODS**	OpenDocument Spreadsheet
D&E&C	Dissemination-Exploitation-Communication	**XML**	Extensible Markup Language
EU	European Union	**ASCII**	American Standard Code for Information Interchange
FORTH/ ICEHT	Foundation For Research and Technology Hellas/Institute of Chemical Engineering Sciences (Project coordinator)	**RTF**	Rich Text Format
ICT	Information and communication technology	**DOC/DOCX**	Microsoft Word
CERN	European Organization for Nuclear Research	**ODT**	OpenDocument Text
DOI	Digital Object Identifier	**HTML**	Hypertext Mark-up Language
H2020	Horizon 2020	**PDF**	Portable Document Format
GFI	Graphene Flagship Initiative	**TIFF**	Tag Image File Format
GA	Grant Agreement	**PNG**	Portable Network Graphics
DDoS	Distributed Denial-of-Service	**JPEG**	Joint Photographic Experts Group
DLP	Data Loss Prevention	**BMP**	Bitmap
SSL/TLS	Secure Sockets Layer and Transport Layer Security	**PSD**	Photoshop
2FA	2-Factor Authentication	**MPEG**	Moving Picture Experts Group
DMC	Data Management Committee	**MP3**	MPEG-1 Audio Layer 3
GDPR	General Data Protection Regulation	**WAV**	Waveform Audio Format

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

URL	Uniform Resource Locator	AIF	Audio Interchange File
PI	Persistent Identifier	MOV	QuickTime Multimedia File
SEO	Search Engine Optimisation	WMV	Windows Media Video
JSON	JavaScript Object Notation	TXT	Text File
MARCXML	MARC 21 format in XML	CC-BY-SA	Creative Commons Attribution Share-Alike
FundRef	Funder Registry		

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

EXECUTIVE SUMMARY

This document is the deliverable "D1.2 Data Management Plan (DMP)" of the European project "GRAPHERGIA – Innovative pilot lines for sustainable graphene-based flexible and structural energy harvesting and storage devices" (Grant Agreement (GA) number 101120832).
This initial version of the DMP defines the general framework to data management in GRAPHERGIA, provides an overview of the datasets to be collected in the project, and outlines the methodology that will be used for the generation, accessibility, re-use, curation, storage, preservation, and exploitation of data. In specifics, the document provides the general policy for data management, the procedure for data and meta-data collection and publication, an overview of the types of data that will be produced, options for security and storage of data, accessibility issues (what data will be open for all and what data will be exclusively for the consortium members and the European Commission (EC)), allocation of resources, and ethical aspects regarding data management.
GRAPHERGIA DMP will ensure that the consortium's data management policy regarding research data management follows the FAIR principles (Findable, Accessible, Interoperable, and Reusable) and that GRAPHERGIA data is "as open as possible and as closed as necessary", as it is important that research findings are open to the wider research community, potential future partners, and other stakeholders. The DMP is a living document that will be modified and refined during the project lifetime.

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

1 INTRODUCTION

A Data Management Plan (DMP) is a crucial document that outlines how data will be handled during and after a Horizon Europe (HEU) project to ensure the data is well-organized, accessible, and preserved. A DMP defines the FAIR data guidelines that should be followed during the project in order to improve the findability, accessibility, interoperability, and reusability of research data. These guidelines serve as a foundation for enabling data and metadata to be discovered and used by both humans and machines efficiently.

This document is based on the Horizon 2020 (H2020) template provided by the EC for a DMP **[1]** and is comprised of the following sections:

- Section 2 presents a short description of the data to be collected or generated in the case of GRAPHERGIA, as well as the origin of data, i.e., whether it was new, reused, or derived from existing data.
- Section 3 describes the three repositories that are going to be used in GRAPHERGIA.
- Section 4 briefly explains the data management procedure that will be used in GRAPHERGIA.
- Section 5 presents the FAIR guidelines to ensure that data can be easily shared, understood, and used not only by current researchers but also by future generations and machines.
- Section 6 presents the resources and methods for data storage during and after the project.
- Section 7 describes the protections against unauthorized access.
- Section 8 discusses the ethical issues related to data collection and sharing, especially concerning human subjects.
- Section 9 defines specific responsibilities related to data management, storage, and sharing in GRAPHERGIA.
- Section 10 summarizes the overall strategy and intentions of data management within the GRAPHERGIA project.

The GRAPHERGIA DMP will undergo updates at each periodic review/assessment of the project, with a final version being prepared for the project's concluding review. Furthermore, updates to the DMP are anticipated whenever significant project changes arise, such as the addition of new data sets, modifications in consortium policies, or the impact of external factors.

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

2 DATA SUMMARY

2.1 ORIGIN OF THE DATA

The objectives of the GRAPHERGIA project will be achieved by implementing the work organized in seven (7) Work Packages (WP): five (5) technical and two (2) devoted to Management (WP1) and Dissemination-Exploitation-Communication ((D&E&C), WP7) activities. The structure of the Work Plan, and therefore the information flow within GRAPHERGIA, is schematically illustrated in **Figure 1**.

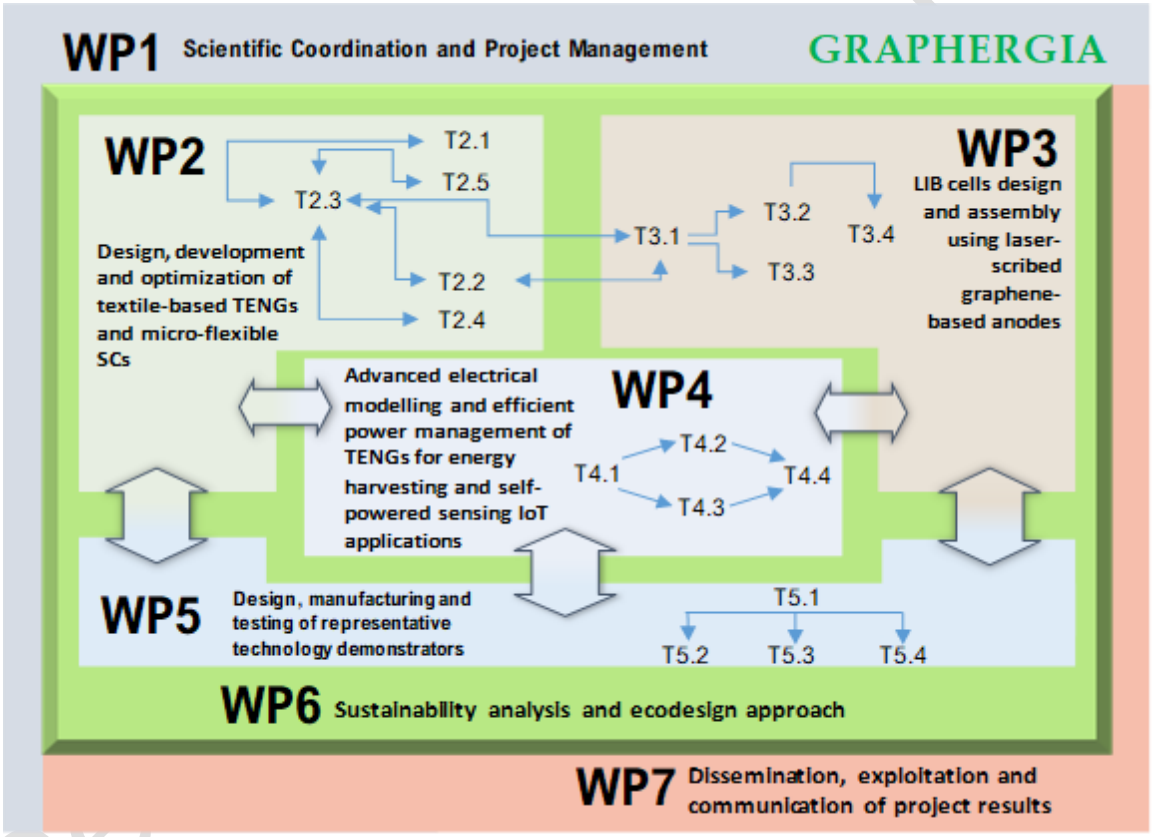


Figure 1. The structure of the Work Plan, and therefore the information flow, within GRAPHERGIA

WP1 and WP7 run in parallel during the project lifespan. WP1 will provide the project with efficient management, facilitating and monitoring the beneficiaries' cooperation to ensure successful progress of the project, while WP7 considers in detail D&E&C activities to a wide range of target groups. WP1 will also address communication with the EC and will guide the consortium via a responsible data management plan in the frame of Open Science.

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

WP6 gathers all necessary tools for a robust life cycle, life cost and social life cycle assessment intertwined with an eco-design approach to define the toolbox needed to achieve project objectives for demonstrating graphene's potential in smart clothing and energy storage products and processes via an environmentally safe and citizen-centered approach, bound to the European Union (EU) circular economy framework.

WP6 is a platform on which WP2, WP3 and WP4, representing the highly innovative parts of the proposed work, lean on. These WPs focus on the safe use of materials and green processes to manipulate and functionalise graphene, implement novel robust electrodes and integrate them into devices. WP2 focuses on the development of TENG-based e-textiles, and WP3 is devoted to the advancement of an innovative power management system of TENGs and the implementation of a modular IoT system prototype for TENG-based applications. WP4 activities deal with the application of laser-fabricated electrodes for high power LIB cells. WP5 develops validated prototype demonstrators to showcase the exploitation potential of GRAPHERGIA innovations.

In order to have an initial, clear and overarching view of what kinds of data will be generated or collected from the research outputs of the project, all partners were asked to complete the questionnaire in "**Appendix A. Questionnaire on expected Research Outputs for Data Management Plan (DMP)**" The responses given are summarized in the paragraphs below.

The Data Origin section will be expanded throughout the project life cycle and more detailed information will be given in the next DMP versions regarding:

1. Data Collection Methods, i.e., the specific techniques and processes used to collect or generate the data (e.g., experiments, observations, sensors, simulations etc.)
2. Existing Datasets, i.e., their sources identification (e.g., publicly available, acquired from a repository, or obtained through previous research activities) and the processing or modifications applied to integrate the existing data into the project.
3. Data Provenance, which involves detailing the steps that will be taken to track and document any changes, ensuring that the dataset's lineage is clear and transparent.

2.2 DATA TYPES AND FORMATS

The data types and formats presented in this section were initially derived from the partners' responses to the questionnaire in Appendix A and they will be updated during the evolution of the project.

Data types

A non-exhaustive list of the data types identified at this starting point in GRAPHERGIA is the following:

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

- Publication
- Dataset
- Report
- Software
- Text
- Image
- Audiovisual
- Workflow
- Model representation
- Collection
- Physical object

Data formats

The data formats recommended for use in GRAPHERGIA are given in **Table 1**.

Type of data	Recommended formats
Quantitative tabular data with minimal metadata. A matrix of data with or without column headings or variable names, but no other metadata or labeling	Comma-Separated Values (CSV) file (.csv). Widely-used formats: MS Excel (.xls/.xlsx), OpenDocument Spreadsheet (.ods).
Quantitative tabular data with extensive metadata A dataset with variable labels, code labels, and defined missing values, in addition to the matrix of data	Some structured text or mark-up file containing metadata information, e.g. XML file.
Qualitative data Textual Documentation and scripts	Plain text data, ASCII (.txt). Rich Text Format (.rtf). Widely-used proprietary formats: MS Word (.doc/.docx), MS Excel (.xls/.xlsx). OpenDocument Text (.odt). Hypertext Mark-up Language (.html). PDF/A or PDF (.pdf).
Digital image data	TIFF (uncompresed) (.tif, .tiff). PNG (.png). JPEG (.jpeg, .jpg). BMP (.bmp). Photoshop files (.psd).
Digital audio data	MPEG-1 Audio Layer 3 (.mp3).

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

	Waveform Audio Format (.wav). Audio Interchange File Format (.aif).
Digital video data	MPEG-4 (.mp4). MOV (.mov) Windows Media Video (WMV) (.wmv).

Table 1. The recommended data formats in GRAPHERGIA

2.3 SENSITIVE DATA

Even though a large number of the data generated or collected in GRAPHERGIA will be made publicly available, some other data will be classified (i.e., data that has commercial value, or personal data that cannot be fully anonymized) and therefore have to be kept confidential.

Confidential data should be accessible either by all partners, or by a subset of partners (named as "data owners"). The first type of confidential data is defined as "**Restricted data**" and the latter type as "**Closed data**".

The Restricted data produced in GRAPHERGIA should be stored in GRAPHERGIA Teamspace, where all partners have access, and the Closed data should be stored in a corresponding private space maintained by the appropriate data owners.

FORTH/ICEHT has established and maintains such private spaces in its own Information and communication technology (ICT) infrastructure (https://cloud.iceht.forth.gr/drive), equipped with robust security measures, and it is recommended to be used for Closed data storage by the data owners.

The access levels of data produced within the GRAPHERGIA project will be determined based on the nature of the data, ethical considerations, legal requirements, and the data sharing policies of beneficiaries.

At this starting point, four access levels are defined within the GRAPHERGIA project:

- **Open**: Open access data is made publicly available with minimal restrictions
- **Embargoed**: Embargoed access refers to data that is temporarily restricted and planned to be made publicly available after a certain period.
- **Restricted**: Restricted access data is available under certain conditions to all partners
- **Closed**: Closed access data is highly sensitive and is restricted to a select group of individuals who are directly involved in their production or use.

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

3 GRAPHERGIA REPOSITORIES

In GRAPHERGIA project we will use the Zenodo repository for sharing public open access data, as well as two private repositories: (a) the GRAPHERGIA Teamspace, for making content available to all project beneficiaries, and (b) the FORTH/ICEHT private spaces for sharing data with individual stakeholders.

3.1 ZENODO

GRAPHERGIA's approach involves making all data pertinent to the stakeholders accessible through open access publications or their electronic supplements.

Zenodo [**2**] is a free and open access repository where researchers can deposit datasets, research software, reports, and any other research-related materials. It was created by the OpenAIRE EU project and CERN (the European Organization for Nuclear Research) **[3]** and launched in 2013, with the aim of allowing researchers to share and preserve any form of scientific data, including publications, data sets, and software. Zenodo supports the principles of open science by providing tools for scientists to make their research findings available to the wider public, thus facilitating open collaboration and encouraging transparency and reproducibility in research.

One of the key features of Zenodo is that it assigns a Digital Object Identifier (DOI) to each submission, making the stored items easily citable in academic literature. This also helps in ensuring long-term access and preservation of the data.

GRAPHERGIA will adhere to the H2020 Open Access Mandate [4] by utilizing the open access research data repository Zenodo. It will upload all scientific publications, public deliverables, and the public parts of the supporting datasets to this platform.

The GRAPHERGIA community collection at Zenodo (**Figure 2**) is accessible via the following URL:

https://zenodo.org/communities/graphergia_heurope

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

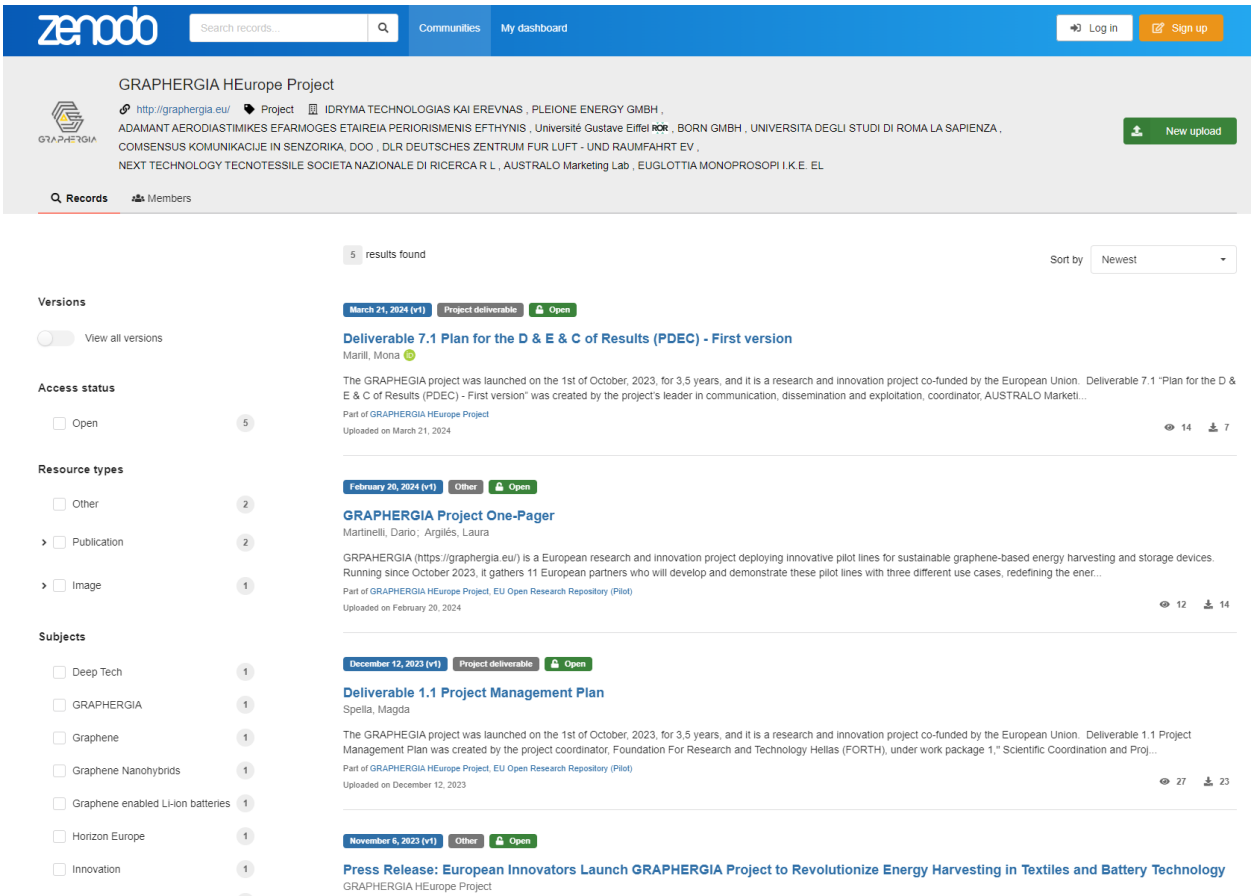


Figure 2. The GRAPHERGIA community collection at Zenodo

Should there be any further data of importance to the stakeholders that cannot be included in the said publications or their supplements, it will be provided through a repository.

In the case where additional data is available but cannot be published and have to be kept confidential (see **2.3 Sensitive data**), but yet are of relevance to the stakeholders, it is recommended to be made available via an **internal repository** (i.e., GRAPHERGIA Teamspace in case of Restricted data or FORTH/ICEHT private spaces in case of Closed data), and to **additionally use Zenodo only for declaring their metadata**.

3.2 GRAPHERGIA TEAMSPACE

For communication between all the GRAPHERGIA partners, an internal Teamspace was created and operates, to which only the members of the consortium have access. GRAPHERGIA Teamspace is established using the Graphene Flagship Initiative (GFI) Onboard **[5]**, a Sharepoint collaborative space for the GFI, and its basic layout is displayed in **Figure 3.**

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

The content of GRAPHERGIA Teamspace is organized in the following sections:

- Pages: A collection of static web pages containing internal information for project beneficiaries.
- News: Everything new that happens in the project is shown here in chronological order.
- Research Outputs: A comprehensive list of the research outputs of the project.
- Events: An event catalogue suitable for managing, coordinating and informing members regarding the project.
- Shared Documents: A hierarchical structure for storing shared data files of the project.
- Deliverables: A complete list of the public deliverables of the project.

Every GRAPHERGIA member, who has been granted access to Teamspace, is able to edit its content and a history record of revisions made to each post is maintained.

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

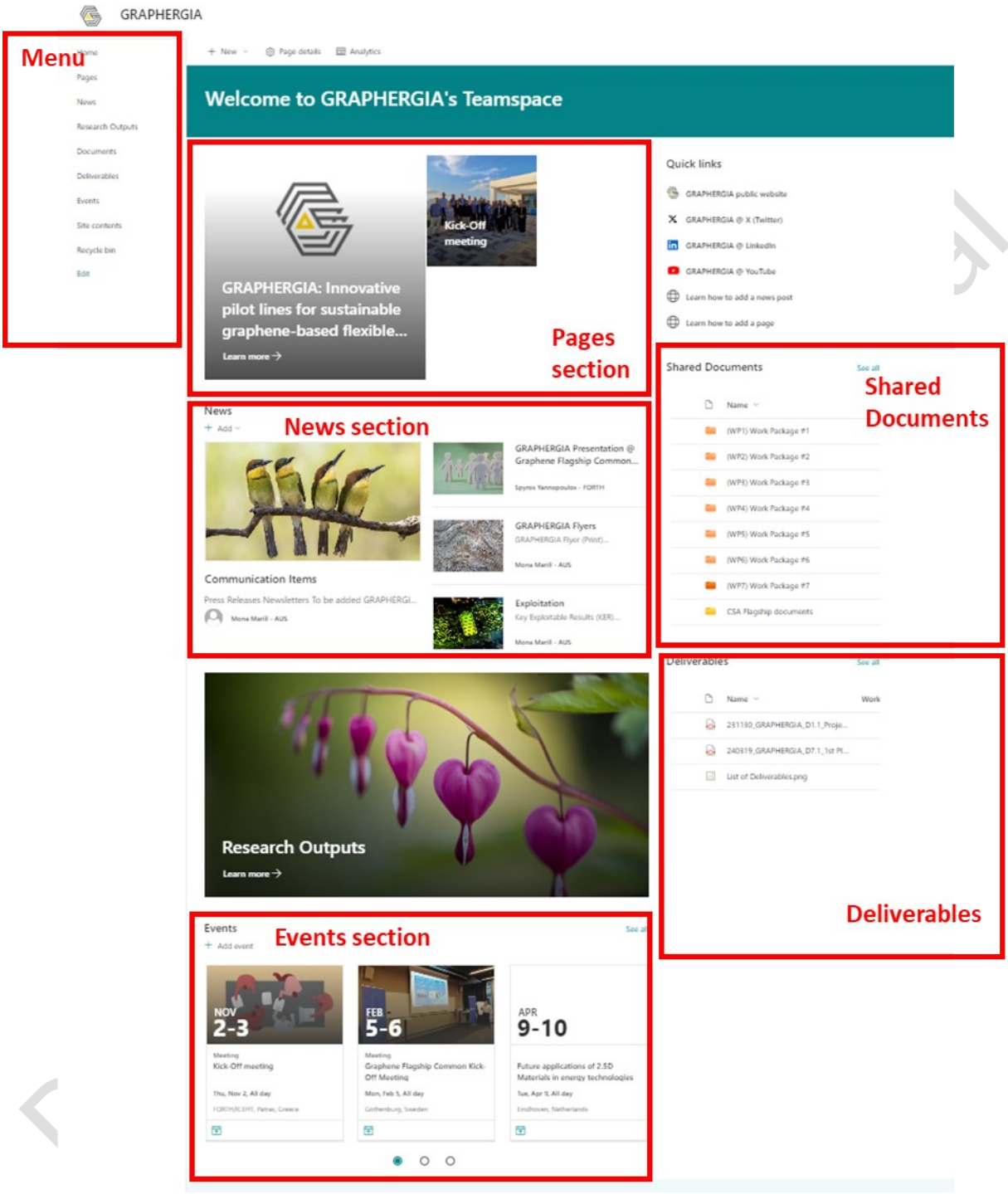


Figure 3. GRAPHERGIA Teamspace layout

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

3.3 FORTH/ICEHT PRIVATE SPACES

FORTH/ICEHT has established and maintains private storage spaces in its own ICT infrastructure (https://cloud.iceht.forth.gr/drive), equipped with robust security measures, and it is recommended to be used for Closed data storage by the data owners (see **2.3 Sensitive data**).

Communication with these private spaces is fully SSL/TLS (Secure Sockets Layer and Transport Layer Security) encrypted and login to them is highly protected by a 2-Factor Authentication (2FA) security process (**Figure 4**).

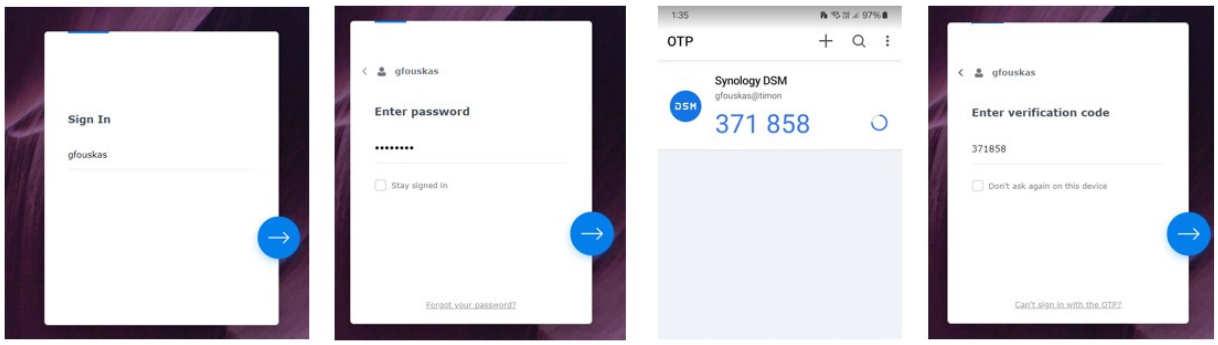


Figure 4. FORTH/ICEHT private spaces login process

Upon successfully logging into a private space, a user is able to effortlessly create a folder and establish his/her own unique access requirements for it. For example, the GRAPHERGIA-WP1 folder shown in **Figure 5** was set up with varying access permissions for three individuals interested in viewing and modifying the folder's contents.

FORTH/ICEHT private spaces are accessible via Web and also by using the appropriate desktop (Windows, MacOS, Linux) and mobile (Android, Apple iOS) applications.

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

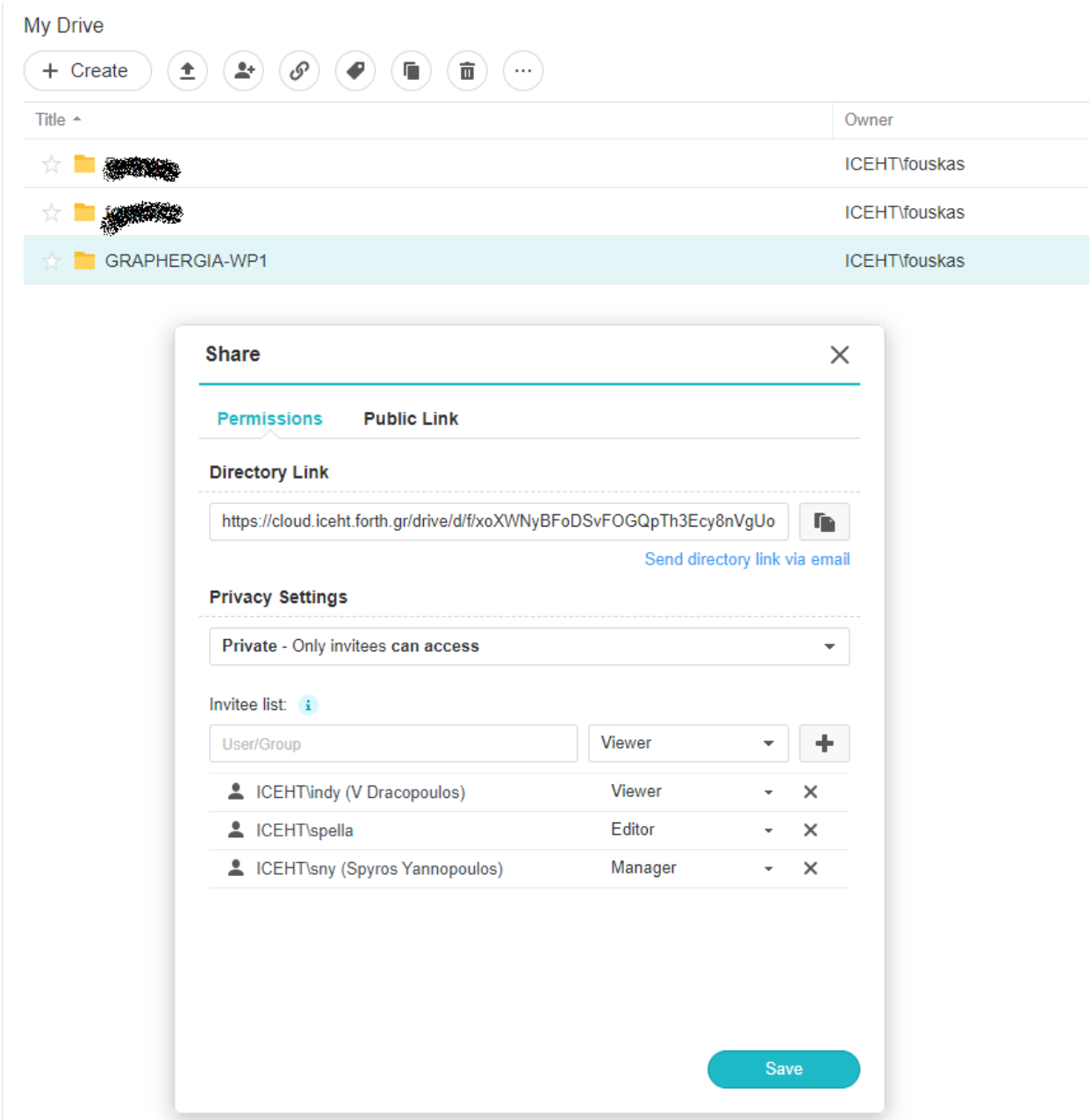


Figure 5. An example of assigning different folder access permissions in FORTH/ICEHT private spaces.

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

4 GRAPHERGIA PROCEDURE FOR DATA MANAGEMENT

Figure 6 illustrates the main procedure used in the GRAPHERGIA project for data management.

When a new research data is collected or generated during the project, the corresponding scientist (**Data provider**) submits it to the **Data Management Committee (DMC)** for approval. The DMC reviews data, based on its metadata information, detailed descriptions provided by the provider, or any other relative information from third-party sources such as stakeholders, public bodies, society etc., and approves it for further processing or not.

If the research data is approved by the DMC, then it is characterized as a **Public, Confidential**, **Restricted,** or **Closed data**.

In the case of public open access data, the DMC checks its FAIRness, i.e., evaluates how well the data complies with FAIR principles for making data Findable, Accessible, Interoperable, and Reusable. Following this evaluation, the data is passed on to the **Dissemination team**, who are responsible for appropriately distributing it across various public platforms such as Zenodo, the public website, X, LinkedIn, YouTube, and others.

In the case of confidential data, the DMC carefully considers the legal, ethical, and security measures, along with licensing and intellectual property concerns, to ensure that sensitive information is adequately protected throughout the project life cycle. Subsequently, this sensitive data is either stored in the **GRAPHERGIA Teamspace**, accessible to all beneficiaries, or in a **Private space**, restricted to the data owners and specific authorized users. For the latter scenario, the use of FORTH/ICEHT private spaces is advised.

Managing confidential data is an ongoing process that requires vigilance, adherence to best practices, and an understanding of the evolving landscape of data privacy and security. Ensuring the confidentiality, integrity, and availability of sensitive data protects beneficiaries' properties, maintains trust, and complies with legal obligations.

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

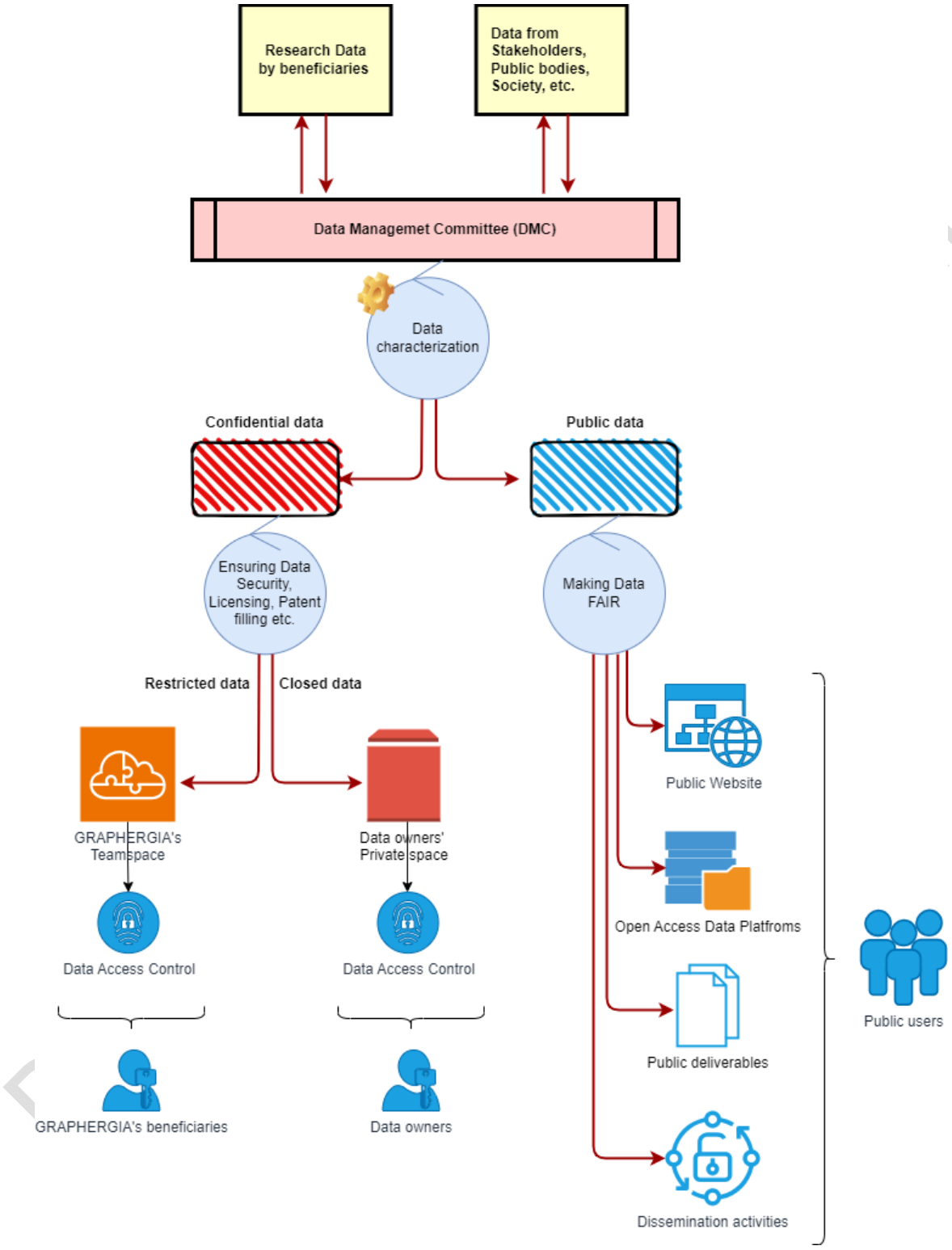


Figure 6. GRAPHERGIA procedure for data management

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

4.1 A COMPREHENSIVE LIST OF GRAPHERGIA RESEARCH OUTPUTS

The "**Research Outputs**" section of the GRAPHERGIA Teamspace illustrates a comprehensive list of data that has been generated or collected up to this point in the GRAPHERGIA project (**Figure 7**).

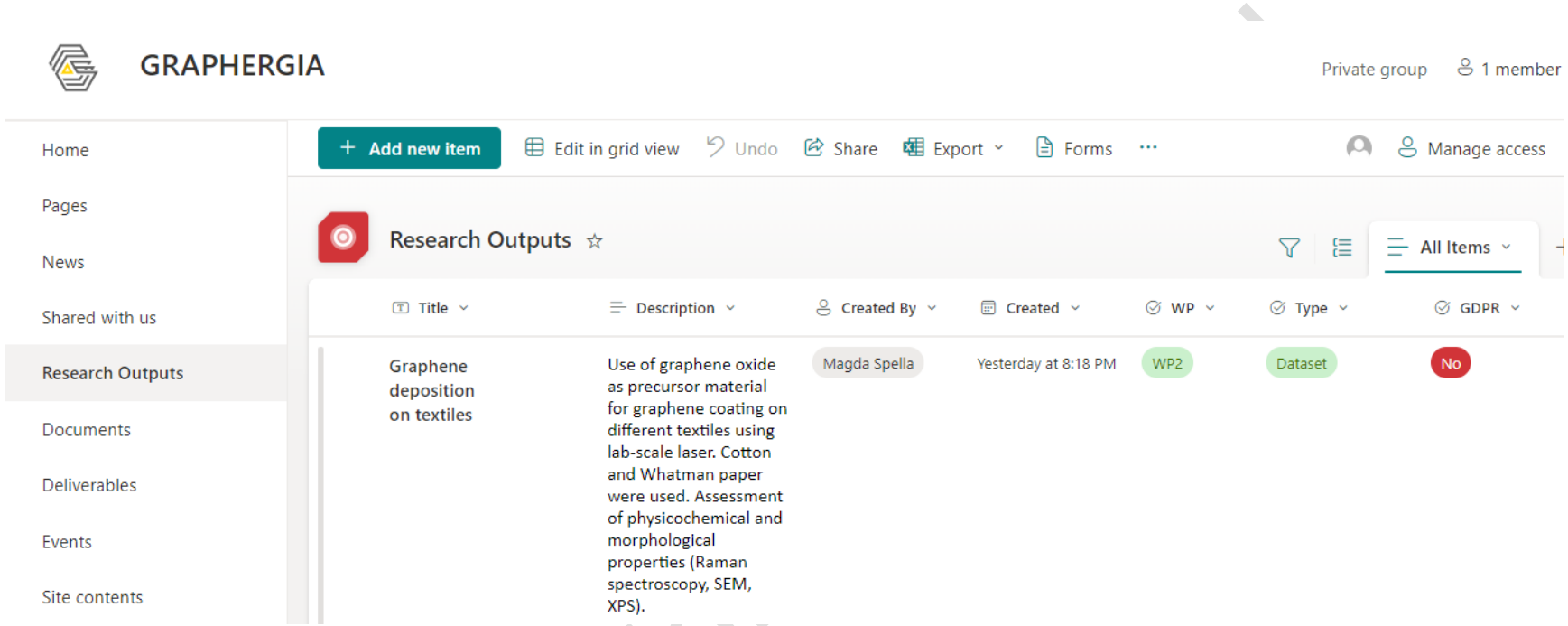
When a new research data is collected or generated during the project, the corresponding scientist (**Data provider**) creates a new item in the Research Outputs list (**Figure 8**), providing some initial necessary information on it such as:

- **Title**: The title of the research output.
- **Description**: A short description of the research output. The data collection method applied and the use or not of pre-existing datasets have to be defined here.
- **WP**: In which Work Package does this research output be collected or generated? Single selection among {WP1, WP2, WP3, WP4, WP5, WP6, WP7} choices.
- **Type**: The type of the research output. Single selection among {Publication, Dataset, Report, Software, Text, Image, Audiovisual, Workflow, Model representation, Collection, Physical object} choices. The user can add values manually.
- **General Data Protection Regulation (GDPR)**: Does this research output contain personally identifiable information? Single selection among {Yes, No} choices.
- **Access level**: The access level of the research output. Single selection among {Open, Embargoed, Restricted, Closed} choices.
- **Stored at**: The repository where the research output is stored. Single selection among {Zenodo, Public website, Teamspace, Social media, Private space} choices.
- **URL / PI**: The Uniform Resource Locator (URL) or the Persistent Identifier (PI) of the research output.
- **License**: The license of the research output. Single selection among {CC-BY-4.0, CC-BY-NC-4.0, CC-BY-NC-SA-4.0, CC Zero} choices. The User can add values manually.
- **Notes**: Some extra notes regarding this research output.

Additionally, the system automatically appends the **name of the User** who adds the new item, along with the **Date it was created**, to this record.

Upon the addition of new research data to the Research Outputs list, the **DMC** members are notified to follow the steps outlined in the previously described data management procedure. If the DMC approves the data, the respective field is updated to 'Yes,' and the '**Approval date**' field is accurately filled out.

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832



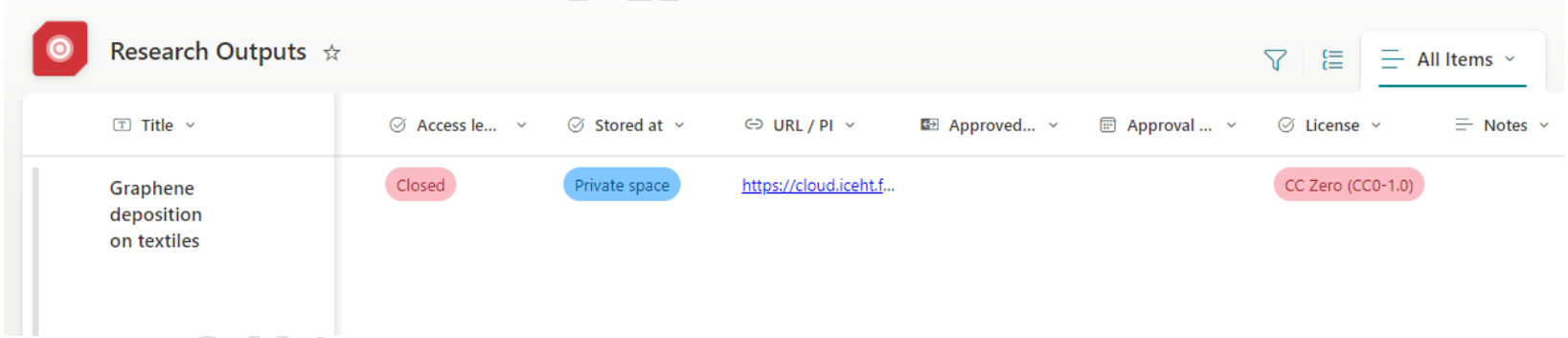


Figure 7. The "Research Outputs" section presents a comprehensive list of data that has been generated or collected up to this point

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

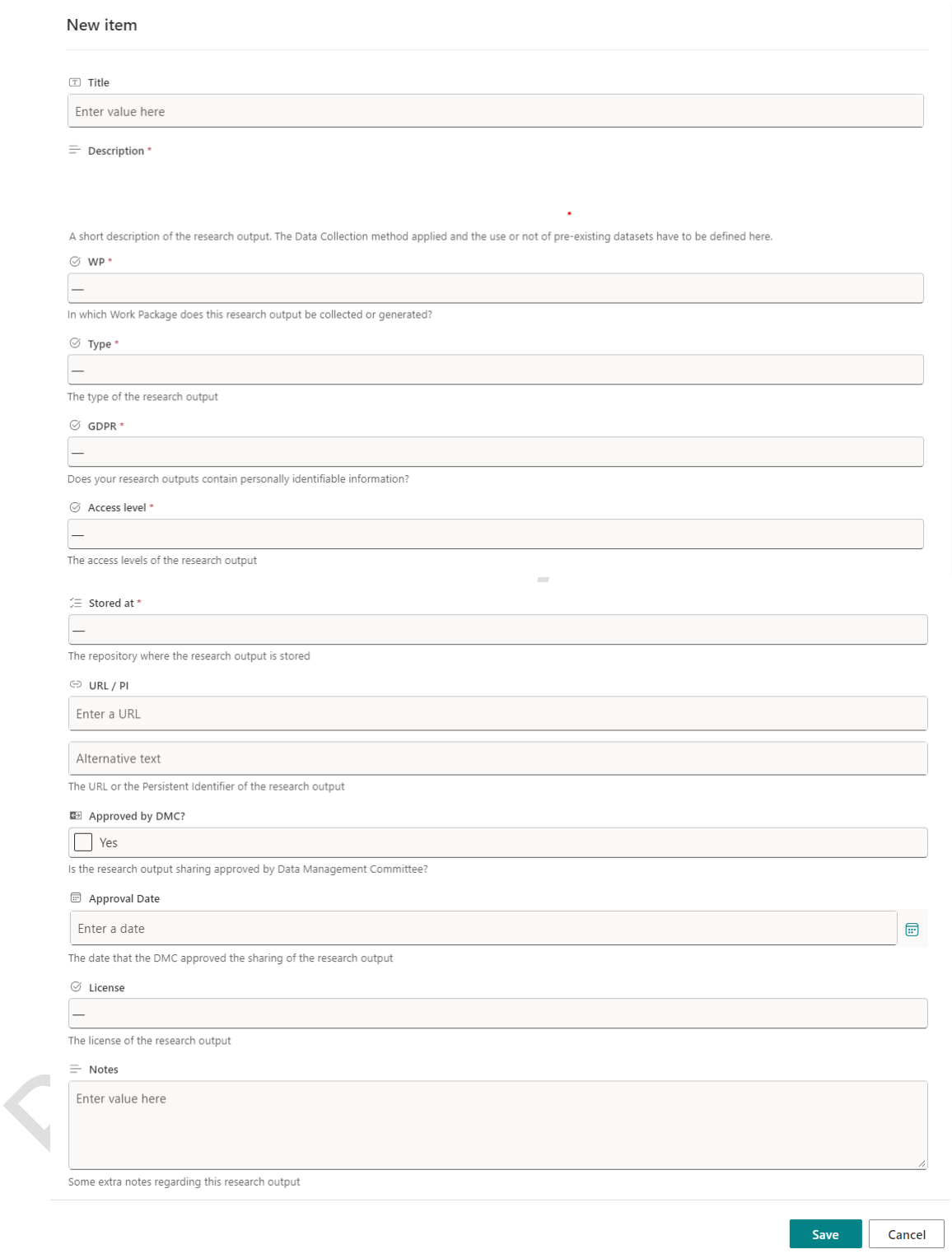


Figure 8. The data entry form for a research output

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

5 FAIR DATA

5.1 MAKING DATA FINDABLE, INCLUDING PROVISIONS FOR METADATA

The GRAPHERGIA project prioritizes the findability, discoverability and identifiability of its research data. According to the document management guidelines, each version of a document is identified at the beginning of the document. File names includes at least a version number and/or a time stamp.

All project generated data, except closed and confidential data, is consolidated in the GRAPHERGIA Teamspace, serving as the central repository for all consortium members.

Open access data from the GRAPHERGIA project is uploaded to the GRAPHERGIA community collection on Zenodo (https://zenodo.org/communities/graphergia_heurope). Each submission is enhanced with Zenodo's standard metadata, including the Grant Number and Project Acronym, to facilitate organization and identification. Zenodo ensures version control and assigns DOIs to each uploaded item, enhancing the traceability and citation of the data. The metadata for each dataset published on Zenodo is set to include the following default information:

- Digital Object Identifiers
- Bibliographic information
- Keywords
- Abstract/description
- Associated project and community
- Associated publications and reports
- Grant information with the project name and GA number
- Access and licensing info
- Language

Also, for the public, data is disseminated through the project's website (https://graphergia.eu), employing standard Search Engine Optimisation (SEO) strategies to enhance data visibility and discoverability based on specific keywords.

5.2 MAKING DATA OPENLY ACCESSIBLE

The Horizon Open Access Mandate is designed to ensure the accessibility of research data produced by HEU projects, while also recognizing the need to protect personal, sensitive data due to privacy, commercial, or security considerations. This mandate facilitates the open dissemination

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

of all public datasets, scientific publications, and deliverables produced under the GRAPHERGIA project. Specifically, project deliverables designated as public in the Description of Action will be openly shared through the project's website (https://graphergia.eu) and the GRAPHERGIA community collection on Zenodo (https://zenodo.org/communities/graphergia_heurope). To foster connectivity and enhance discoverability, publications and the corresponding datasets will be interconnected through the use of persistent identifiers (DOIs), ensuring version control.

For datasets classified with a "confidential" dissemination level, sharing will be restricted to safeguard commercial interests.

The project's publications will primarily adopt the 'gold open access' route, alongside the 'green open access' pathway for certain outputs. For green open access, Zenodo will serve as the principal repository for self-archiving purposes. In the context of gold open access, adherence to the scientific publisher's open access policies, including any embargo periods, is essential to comply with the EC open access requirements. Moreover, the chosen publishing platform must provide a DOI for each publication to meet these standards.

Additionally, efforts will be made to feature the publications on the project's website, provided this does not violate the publisher's copyright policies. This approach not only aligns with the Horizon Open Access Mandate's goals but also underlines a commitment to making scientific discoveries accessible to a broader audience while respecting legal and ethical boundaries.

5.3 MAKING DATA INTEROPERABLE

As data collection and generation are ongoing processes, determining the exact steps to ensure data interoperability is challenging at this stage. The evolving nature of data acquisition means that strategies for enhancing interoperability will need to be adaptive, focusing on standards and formats that promote ease of use and exchange across different systems and disciplines once the dataset is more defined.

However, the types of raw data expected, such as ASCII or TXT, are versatile, compatible with numerous standard software packages like ORIGIN, MATLAB, MATHEMATICA, and Excel, facilitating broad accessibility and analysis.

Also, microscopic image data, typically in formats like JPEG or TIFF, will be compatible with various image processing software, ensuring adaptability in data handling and analysis as the project evolves.

Furthermore, Zenodo employs a JavaScript Object Notation (JSON) schema for its metadata's internal structure, enabling conversion into various formats like MARCXML (MARC 21 format in XML), BibTeX (reference management software for formatting reference lists), and others, facilitating integration with Mendeley. The platform's metadata utilization aligns with Zenodo-specific vocabularies and references-open, external vocabularies for elements like licenses (Open

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

Definition) and funders (FundRef, Funder Registry), using resolvable URLs for external metadata. This approach enhances the metadata's interoperability and accessibility, ensuring broad compatibility and ease of use for research and academic purposes.

5.4 INCREASE DATA RE-USE (THROUGH CLARIFYING LICENCES)

The GRAPHERGIA project is committed to ensuring that external parties have the opportunity to access, utilize, replicate, and share all datasets designated as public. In an effort to maximize the potential for widespread reuse of these data sets, the project consortium is dedicated to implementing open licensing frameworks wherever practical. This approach will be grounded in the adoption of common, standardized, and globally recognized licensing models. For instance, the consortium intends to employ the 'CC-BY-SA 4.0' (Creative Commons Attribution Share-Alike 4.0) license as a fundamental guideline for the licensing of all research data, aiming to promote the broadest possible reuse.

Additionally, it is important to acknowledge that the final determination regarding the specifics of data publishing and sharing, including the selection of appropriate licenses and the timing of data release, will necessitate a comprehensive review. This process will commence only after the project's data sources have been meticulously selected and thoroughly assessed for their suitability and relevance. Such a strategic approach ensures that decisions regarding data dissemination are made with a deep understanding of the data's nature and potential implications, aligning with the project's goals and adhering to legal and ethical standards. This careful consideration underscores the project's commitment to fostering an open and collaborative research environment, facilitating the effective and responsible sharing of knowledge.

6 ALLOCATION OF RESOURCES

In GRAPHERGIA project we will use the Zenodo repository for sharing public open access data, as well as two private repositories: (a) the GRAPHERGIA Teamspace, for making content available to all project beneficiaries, and (b) the FORTH/ICEHT private spaces for sharing data with individual stakeholders.

Zenodo **[2]** is a free and open access repository, hosted by CERN **[3]**, and there is no cost for its use. With its virtually limitless storage capacity, Zenodo ensures that concerns about adequate storage space will not arise throughout the GRAPHERGIA project. Also, Zenodo supports long-term preservation of data deposits, as the repository is projected to be maintained for the lifetime of the host laboratory CERN, defined as at least the next twenty years (see Zenodo's Policies **[6]**).

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

The GRAPHERGIA Teamspace has been set up through the GFI Onboard **[5]**. This platform is provided free of cost, and the GFI guarantees sufficient storage space as well as data accessibility for at least five years following the project's conclusion.

FORTH/ICEHT offers and maintains private storage spaces within its ICT infrastructure at no charge to the consortium. Initially, 200GB of storage space is allocated for GRAPHERGIA, with the possibility of expansion if necessary. FORTH commits to keeping the data accessible for a minimum of five years after the completion of the project.

Expenses associated with managing research data qualify for coverage under the project grant. The tasks involved in generating, collecting, and curating data fall within the scope of person-months (and thus are considered direct personnel costs), as outlined in the GA for each partner. Also, every partner has designated funds to ensure data availability through open access publications.

There is no anticipation of resource allocation beyond what is already committed to the project. However, if additional costs are foreseen, this will be included in an update of the DMP.

7 DATA SECURITY

Zenodo's entire technical infrastructure is located on CERN's premises and follows CERNS' data security policies and measures **[7]**, which ensures integrity, authenticity, accountability and prevention of data breaches. Regarding availability and longevity, Zenodo provides data files versioning, replicas, preservation and succession plans **[6]**.

GRAPHERGIA Teamspace is hosted at Microsoft's Cloud Services Center which, particularly through Azure, offers a comprehensive security framework designed to protect multicloud and hybrid environments. Their approach integrates various layers of security across physical data centers, infrastructure, and operations. Azure provides multi-layered security, leveraging custom hardware with integrated security controls and protection against threats such as DDoS (Distributed Denial-of-Service) attacks **[8]**.

FORTH/ICEHT provides a comprehensive suite of security measures to protect data and infrastructure within the cloud environment, in order to maintain the confidentiality, integrity, and availability of data and sharing service. These include encryption of data both in transit and at rest, Data Loss Prevention (DLP) tools to prevent unauthorized access or exposure, and regular backups for data recovery in case of incidents. Also, FORTH/ICEHT provides visibility into malicious activity by aggregating data from across the environment, supporting incident response and alert qualification, and has capabilities to identify data threats and respond quickly, using global cybersecurity intelligence and real-time data analysis.

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

8 ETHICAL ASPECTS

The ethical dimensions of the GRAPHERGIA project will be addressed under WP1 and in deliverables D1.1 (Project Management Plan) and D1.2 (Data Management Plan).
Key obligations of the project, regarding data collection ethics, include:

- The appointment of a Data Management Committee (DMC), which will address all ethical data collection issues.
- The definition of standardized procedures (including security and confidentiality measures) and consent templates for any personal data collection occurrence, according to the GDPR principles. Research data will be fully protected (e.g., through pseudonymisation or anonymisation). Any indirect reference to sensitive data (for example industrial or business data) will be removed and destroyed after the anonymised dataset has been checked and validated. Any personal data will not be used unless informed consent has been obtained. The DMC will ensure safe keeping of all informed consent forms in an internal secure private space using the corresponding FORTH/ICEHT service. GRAPHERGIA Informed Consent Form is shown in **Appendix B. Informed consent form to participate in research activities of the Project GRAPHERGIA**.
- The provision of support to the project partners about when and where approvals are needed, how to deal with personal data and where informed consent is needed, e.g., addressing informed consent procedure for communication with stakeholders.

9 ROLES AND RESPONSIBILITIES

The responsibilities of the **DMC** include coordinating activities and recommending policies to enhance the quality, consistency, security, and accessibility of data. The DMC is crucial for resolving data definition discrepancies, prioritizing activities to improve data consistency and accuracy, and recommending process, training, and system changes to enhance data quality. It also advises on policies for data access compliance and on ethical and privacy issues, **acting as an advisory and approval body** for data definitions and sources. The DMC works closely with project management and technical partners to create and periodically update the Data Management Plan. This effort is guided by a designated **Data Officer**.

GRAPHERGIA's **Data Management Committee** is composed of the following members:

Name	Partner

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

Spyros Yannopoulos	FORTH
Athanasios Masouras	PLE
Despoina Batsouli	ADA
Philippe Basset	UGE
Michael Schneider	BORN
Tullio Scopigno	URM
Andrej Campa	COMS
Apurba Rey	DLR
Daniele Spinelli	NTT
Mona Marill	AUS
Konsantinos Vavekis	EUGL

Table 2. GRAPHERGIA's Data Management Committee

Work Package Data Managers oversee executing the data management plan within their work packages. Their duties include tracking data management tasks and deadlines, reminding partners, requesting missing details or clarifications, providing tailored support and guidance for open access data publication, and ensuring complete data deposition in designated repositories.

GRAPHERGIA's WP Data Managers are the following:

WP	Name	Partner
WP1	Magda Spella	FORTH
WP2	Spyros Yannopoulos	FORTH
WP3	Athanasios Masouras	PLE
WP4	Philippe Basset	UGE
WP5	Despoina Batsouli	ADA
WP6	Daniele Spinelli	NTT

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

WP7	Mona Marill	AUS

Table 3. GRAPHERGIA's WP Data Managers

Finally, the **Data Provider/Scientist**'s duties include notifying data managers about newly available data, documenting the data using specified metadata in line with the DMP and utilizing provided tools (e.g., Research Output form), and uploading the data to designated repositories as per the DMP's guidelines.

10 CONCLUSIONS

This document summarises the initial Data Management Plan (DMP) of the GRAPHERGIA project. It outlines the means to handle the research data during and after the project end, specifies the data that will be collected, processed and/or generated, defines the procedure to determine whether this data will be publicly available or confidential, and describes how data will be curated and preserved (including after the end of the project). The document also addresses several aspects on how to make the GRAPHERGIA data as FAIR as possible, following the indications provided by the EC.

GRAPHERGIA DMP will be a living document, periodically revised throughout the project, by integrating new data, procedures and ideas raised from further discussions among the project consortium and the stakeholders. Any update of the DMP will be included in the periodic reports.

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

REFERENCES

[1] TEMPLATE HORIZON 2020 DATA MANAGEMENT PLAN (DMP), https://ec.europa.eu/research/participants/data/ref/h2020/other/gm/reporting/h2020-tpl-oa-data-mgt-plan-annotated_en.pdf

[2] The Zenodo repository, https://www.zenodo.org/

[3] Conseil Européen pour la Recherche Nucléair, https://home.cern

[4] Horizon 2020 Mandate On Open Access To Publications, https://ec.europa.eu/research/participants/docs/h2020-funding-guide/cross-cutting-issues/open-access-data-management/open-access_en.htm

[5] Graphene Flagship Initiative Onboard, https://grapheneflagship.sharepoint.com/sites/HEonboard/

[6] Zenodo's Policies, https://about.zenodo.org/policies/

[7] Zenodos's Infrastructure, https://about.zenodo.org/infrastructure/

[8] Azure's Security, https://azure.microsoft.com/en-us/explore/security

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

APPENDIX A. QUESTIONNAIRE ON EXPECTED RESEARCH OUTPUTS FOR DATA MANAGEMENT PLAN (DMP)

What will be the various forms of your research outputs?

- ☐ Publication
- ☐ Dataset
- ☐ Report
- ☐ Software
- ☐ Text
- ☐ Image
- ☐ Audiovisual
- ☐ Workflow
- ☐ Model representation
- ☐ Collection
- ☐ Physical object
- ☐ Other, please specify: _____

What will be the various formats of your research outputs?

The following table contains the recommended file formats.
Do you agree on that?

- ☐ Yes
- ☐ No

Are there any other data formats that we should add? If so, please specify: _____

Type of data	Recommended formats
Quantitative tabular data with minimal metadata.	Comma-separated values (CSV) file (.csv).

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

A matrix of data with or without column headings or variable names, but no other metadata or labeling.	Widely-used formats: MS Excel (.xls/.xlsx), OpenDocument Spreadsheet (.ods).
Quantitative tabular data with extensive metadata. **A dataset with variable labels, code labels, and defined missing values, in addition to the matrix of data.**	Some structured text or mark-up file containing metadata information, e.g. XML file.
Qualitative data. **Textual.** **Documentation and scripts.**	Plain text data, ASCII (.txt). Rich Text Format (.rtf). Widely-used proprietary formats: MS Word (.doc/.docx), MS Excel (.xls/.xlsx). OpenDocument Text (.odt). Hypertext Mark-up Language (.html). PDF/A or PDF (.pdf).
Digital image data.	TIFF (uncompresed) (.tif, .tiff). PNG (.png). JPEG (.jpeg, .jpg). BMP (.bmp). Photoshop files (.psd).
Digital audio data.	MPEG-1 Audio Layer 3 (.mp3). Waveform Audio Format (.wav). Audio Interchange File Format (.aif).
Digital video data.	MPEG-4 (.mp4). MOV (.mov) Windows Media Video (WMV) (.wmv).

May your research outputs contain sensitive data?

☐ Yes
☐ No

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

May your research outputs contain personally identifiable information?

- ☐ Yes
- ☐ No

Which repository do you prefer to share and showcase your research outputs?

[An international list of data repositories is available @ https://www.re3data.org/]

- ☐ Zenodo (https://zenodo.org/)
- ☐ Other, please specify: _____

What metadata standards do you prefer to help others identify and discover the data?

[A Directory of Metadata Standards is available @ https://rdamsc.bath.ac.uk/]

- ☐ Zenodo's default
- ☐ CERIF (Common European Research Information Format) (https://eurocris.org/eurocris_archive/cerifsupport.org/cerif-in-brief/index.html)
- ☐ Other, please specify: _____

Which would be the access levels of your research outputs?

- ☐ Open
- ☐ Embargoed
- ☐ Restricted
- ☐ Closed
- ☐ Other, please specify: _____

Which would be the license of your research outputs?

[An online guide on selecting a license is available @ https://ufal.github.io/public-license-selector]

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

- ☐ CC-BY-4.0
- ☐ CC-BY-NC-4.0
- ☐ CC-BY-NC-SA-4.0
- ☐ CC0-1.0
- ☐ Other, please specify: _____

What's the anticipated total file size of your research outputs?

- ☐ Please specify: _____ MB

Which member of your Institution/Company is going to participate at the GRAPHERGIA's Data Management Committee?

Name: _____

Title / Role: _____

Email: _____

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

APPENDIX B. INFORMED CONSENT FORM TO PARTICIPATE IN RESEARCH ACTIVITIES OF THE PROJECT GRAPHERGIA

Please read carefully this document before you sign.

You are invited to take part in activities of GRAPHERGIA project. This form contains information that will help you decide whether to join the research activities.

Key contact details

Controller of the data collected

Foundation for Research and Technology Hellas (FORTH), N. Plastira 100, Vassilika Vouton, GR-700 13 Heraklion, Crete, Greece.

Scientific coordinator / contact details

Spyros Yannopoulos, Research Director, Institute of Chemical Engineering Sciences, (ICE-HT), Foundation for Research and Technology Hellas (FORTH). email: sny@iceht.forth.gr

Key information about the GRAPHERGIA Project

Project Coordinator: FORTH

Funding Program: Horizon Europe

Website and contacts: https://www.iceht.forth.gr/en

Description of the research project

GRAPHERGIA aims to develop a new science-based, holistic approach to achieve one-step, laser-assisted synthesis, processing, functionalization and simultaneous integration of graphene-based materials and graphene nanohybrids, directly into relevant energy harvesting/storage devices. This will lead to a scalable, cost-effective and climate-neutral production of (i) e-textiles for smart

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

clothing, with the specific functions of wearable power supplying and self-powered sensors emended in structural components and (ii) next generation electrodes for LIB cells, based on eco-design principles.

The project lasts 3,5 years (running from October 2023 to February 2027) and is funded by the European Commission (contract no. 101120832), within the context of the Horizon Europe programme. There are 11 participants from 6 European countries and in particular:

- FOUNDATION FOR RESEARCH AND TECHNOLOGY – HELLAS (FORTH)
- PLEIONE ENERGY GMBH (PLE)
- ADAMANT AERODIASTIMIKES EFARMOGES ETAIREIA PERIORISMENIS EFTHYNIS (ADA)
- UNIVERSITE GUSTAVE EIFFEL (UGE)
- BORN GMBH KNITWEAR FOR FASHION & ENGINEERING (BORN)
- UNIVERSITA DEGLI STUDI DI ROMA LA SAPIENZA (URM)
- COMSENSUS, KOMUNIKACIJE IN SENZORIKA, DOO (COMS)
- DEUTSCHES ZENTRUM FUR LUFT - UND RAUMFAHRT EV (DLR)
- NEXT TECHNOLOGY TECNOTESSILE SOCIETA NAZIONALE DI RICERCA R L (NTT)
- AUSTRALO INTERINNOV MARKETING LAB (AUS)
- EUGLOTTIA MONOPROSOPI I.K.E. (EUGL)

More information can be found at the project website: https://graphergia.eu/

Personal data

Your identity data (full name, contact details) will be collected when you participate in GRAPHERGIA events (on a voluntary basis) for the purposes of the Dissemination and Communication activities of the project. Selected photographs/screenshots may be used for the communication of the project results in mass media and in publications to inform the public and / or the scientific community. Before taking any photographs/screenshots, you will be asked to give your consent. In case you wish to opt out from the capturing, you can turn off your camera or step away, and the data controller will not use your identifiable data.

Data processing / confidentiality

Where applicable, only the personal data that is absolutely necessary for conducting the relevant research will be collected and processed through the "pseudonymization" process. Your participation will remain confidential. Your personal data will receive a code number and the digital list linking your name to that number will be stored in a secure, locked digital file. When the data is used, your name will not be displayed under any circumstances. The participants' data are

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

protected and kept safe throughout the project. After the completion of the project, the list linking your name to the code number of your data will be deleted. The data processing and analysis will be carried out by the data management committee of the project.

Applicable regulations

The protection of natural persons in relation to the processing of personal data is a fundamental right. The law provides specific rights for natural persons (data subjects) and sets specific obligations for those who keep and process such data (controllers). All applicable EU and national legal frameworks and guidelines on the protection of personal data, as derived from the application of the "General Data Protection Regulation (EU 679/2016)", are being considered in this study.

Rights of participants

In accordance with principles of research ethics and EU data protection regulations, you have rights regarding how your personal data is processed.
You have the right to be informed about your personal data collected in and to have access to them, and the right for these data to be in a portable and easily accessible form. You also have the right to request that your personal data be corrected, updated or deleted, the right to have the processing restricted, and the right to object, with the reservation of any exceptions provided for in existing European and national legislation. We acknowledge also to you, that in accordance with the aforementioned Regulation, you have the right to file a complaint to the corresponding national Data Protection Authority (complaints@dpa.gr).
We aim to fulfil all requests. In accordance with data protection legislation, some requests may be rejected.

Who to contact if you have questions

In order to exercise your rights you may contact the Scientific Coordinator of the project (Spyros Yannopoulos). For any further information regarding FORTH's personal data protection policy, you may visit the website (www.forth.gr) or contact the Data Protection Officer of FORTH at: dpo@admin.forth.gr.

Certificate of Consent

I, the undersigned ..... (name) hereby declare that I agree to participate in this event, in the context of the “GRAPHERGIA” Project – “INNOVATIVE PILOT

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832

LINES FOR SUSTAINABLE GRAPHENE-BASED FLEXIBLE AND STRUCTURAL ENERGY HARVESTING AND STORAGE DEVICES".

The purpose of the activities and my rights have been explained to me in writing (in the information sheet).

I am participating voluntarily and understand that I can withdraw from the research activities[1] without repercussions, at any time, and have my data deleted.

I am satisfied that the assurances of responsible and strict data governance, given by the "GRAPHERGIA" project, will be upheld.

I understand that my personal data are kept and treated as confidential as far as this research project is concerned.

I know and understand that my personal data will be kept in a secure environment and that the data controller, as well as any data processors, will take all the necessary and appropriate measures to protect the security, and in particular the confidentiality and integrity, of personal data, according to data protection legislation and the relevant guidelines.

I explicitly declare that I agree with the publication of the results of this activity in anonymous form and with the publication of selected photographs/screenshots for the promotion of the project in mass media, and / or reports/publications aimed at informing the public and / or the scientific community.

Print name (participant)

.....

Signature (participant)

.....

Date

.....

[1] You may withdraw your consent to this activity, in writing to the Scientific Coordinator of the project, (Spyros Yannopoulos), email: sny@iceht.forth.gr, Foundation for Research and Technology - Hellas (FORTH), Institute of Chemical Engineering Sciences, Stadiou str. Platani, Patras, Greece.

This project is supported by the European Union, under Horizon Europe Programme (Grant Agreement n.101120832