Guidelines for Research Data Management (RDM)

1) Introduction

The purpose of research data management (RDM) is to promote the findability, accessibility, and sharing of data, thereby maximizing the effectiveness and reproducibility of research activities.

This document provides information on all practical aspects of RDM, including:

- the choice of open data repository
- the selection of data to be stored and the methods for doing so
- research software
- usage licences
- the recommended model for preparing a Data Management Plan (DMP)

The guidelines are a continually evolving document designed to keep useful information up to date for those who need to apply the “RDM Policy.” To this end, a web version of the guidelines is being prepared, taking into account the particular characteristics of INRiM and its research areas.

2) Scope of application

In this initial phase, the application of the "RDM Policy" concerns projects funded by third parties, in compliance with the regulations given by the funder. Such projects include, for example, those funded under Horizon Europe and EURAMET programs. The references cited at the end of these guidelines link to European regulations and instructions for preparing DMPs.

3) Treatment and Management of Research Data

Introduction: According to the INRIM Research Data Management Policy, research data (RD) must be stored in an appropriate system and managed in such a way as to be findable, accessible, interoperable, and reusable,1 as well as being evaluable and comprehensive.

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1 FAIR is the acronym of: Findable; Accessible; Interoperable; Reusable (https://www.go-fair.org/).
Appropriate system: An appropriate system is one that can ensure a reasonable level of security and reliability. For example, the following are considered appropriate:

- Data repository (e.g., Zenodo): recommended choice for sharing RD related to projects funded by third parties: Zenodo, INRIM community (see below)
- Cloud storage services (e.g., Google Drive): recommended choice for storing all RD and sharing within INRIM
- Network Attached Storage (NAS)/storage server, provided that it is managed according to certain criteria (redundancy via RAID, periodic backups, continuous software updating, monitoring of hard disk parameters and prompt replacement in case of failures, …)
- External hard drives, provided that they have an updated backup (i.e., a complete and up-to-date copy of the data must be kept on a second support).

The following are **NOT** considered appropriate:

- Personal or laboratory computers.
- Individual researcher/group research websites.
- USB drives.
- CD/DVD.

Research data: "Research data" (RD) refers to all electronic data (e.g. .dat, .txt, .avi, .mp3 files) used to validate the results presented in scientific publications produced within the scope of a research project (see scope of application). Research data also includes software developed for the evaluation and processing of raw data, metadata (see below), and any other material (e.g. images, audio) necessary to understand and reuse them.

Repository: Research data that is made public, for example through publication in a journal, must be deposited in a specific repository for the discipline, if one exists, and in the Zenodo community INRIM data repository ([https://zenodo.org/deposit/new?c=inrim](https://zenodo.org/deposit/new?c=inrim)), indicating the research project.

Metadata: "Metadata" refers to all additional information that identifies a set of research data. A distinction is made between "administrative" and "technical" metadata.

The "administrative" metadata contains information such as:

- Title.
- Description.
- List of authors and their affiliations.
- Keywords.
- Language.
Administrative metadata is usually uploaded directly during the upload phase to the certified repository. It is very important to fill in all the administrative metadata, with the highest possible accuracy, to make your data **Findable**.

The "technical" metadata instead contains information that further characterizes the data. Unfortunately, this characterization depends on the particular type of data, and it is therefore not possible to provide an exhaustive list.

Technical metadata includes, for example:

- Date and time of each measurement.
- Environmental conditions.
- Technical information on the instruments used during the measurement.
- ...

Technical metadata is usually written in the form of a text file, or as a header of files containing the data. To make the research **Interoperable**, metadata must be as standardized and formal as possible. Standards describe common ways to structure and make data understandable. For example, they can take the form of controlled vocabularies and/or ontologies. In reporting metrological metadata, it may be useful to follow the international metrological vocabulary VIM.

**Usage license:** Research data, unless otherwise specified, must be associated with an open usage license according to the "open definition", such as the Creative Commons Attribution 4.0 (CC-BY) license.

Creative Commons licenses do not apply to software products, which instead use open source licenses such as the MIT license or the Apache 2.0 license.

The metadata normally do not have a usage license. In case it is mandatory to indicate one, the Creative Commons Zero (CC0) license must be applied (which applies only to metadata).

### 4) Support

To facilitate the proper implementation of RDM, INRiM will provide its affiliates with appropriate tools and support information including:
• web pages dedicated to RDM/Open science (https://www.inrim.it/it/ricerca/open-science)

- "RDM Policy" and "RDM Guidelines": https://www.inrim.it/it/ricerca/open-science
- template for the preparation of the Data Management Plan (DMP) EURAMET EMPIR/EPM:
- ERC Open Science; information and templates (https://erc.europa.eu/manage-your-project/open-science)
- EURAMET EMPIR/EPM Reporting Guidelines, Part 9 - Preparing data management plans:
- Annotated Model Grant Agreement of Horizon Europe, ANNEX 5 (p.154)
- Horizon Europe Data Management Plan (DMP) template
- Guidelines on FAIR data management in Horizon 2020

• informative documents and examples of application (in preparation)

• direct assistance from Open Science group members

• an FAQ section accessible from the website (in preparation)

Attachment 1 - Definitions (from the Policy)

**Research data:** digital format data produced as the result of a research activity, or illustrating different phases of research work. Particularly, research data include records of numerical data, symbols, text and audio-visuals collected or used to validate scientific results and findings, as
well as the software tools used to analyze and elaborate research data in order to produce the final research results.

Typical examples of research data include those acquired during the measurement process, reference values of physical quantities and laboratory standards, results of investigations and studies, collections of samples and objects, test procedures, simulations and protocols. The wide range and variety of data types reflects the diversity of scientific fields, methodologies and research procedures. Throughout the duration of a project, research data may evolve taking different forms (gradations of raw data, processed data - including negative or inconclusive results, openly shared data, published data), and may as such have different types of access authorization or license attributions.

**Research data management:** includes the organization, acquisition, collection, elaboration, documentation and storage of data, in agreement with the present policy and the instructions further specified in the RDM Guidelines. It ensures access, reuse, reproducibility of research data as the prerequisite to rigorous and transparent scientific results and findings.

**INRiM affiliate:** who contributes to the research activities of INRIM, including the employees and associates of INRiM, postdoctoral researchers, and all others, being e.g. affiliated to other institutions, who are trained at INRIM (e.g. PhDs) or are temporarily visiting INRIM.

**Research project:** the scientific endeavor undertaken in response to a research need, independently from the source of funding. Research projects may include: experimental activities, theoretical investigations, feasibility studies, data processing. Also, the research activities undertaken to fulfill the obligation needed for the achievement of a Bachelor or Master Degree or a PhD title establish a research project. Every research project is supervised by a Project Leader who is responsible for the research data management and the preparation of a DMP.