GUIDELINES FOR DESCRIBING RESEARCH DATA

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This document, prepared within the Finnish Open Science and Research Coordination, provides an overview of the essential elements in research data description. It aims to orient researchers to the processes of data description and to open up these processes on a general level. The focus is on themes related to descriptive metadata. Many organisations and disciplines have developed more detailed guidelines tailored to their researchers, which provide valuable advice, including how to choose the most appropriate repository for specific research data. Researchers are encouraged to consult these discipline-specific guidelines early in their projects.

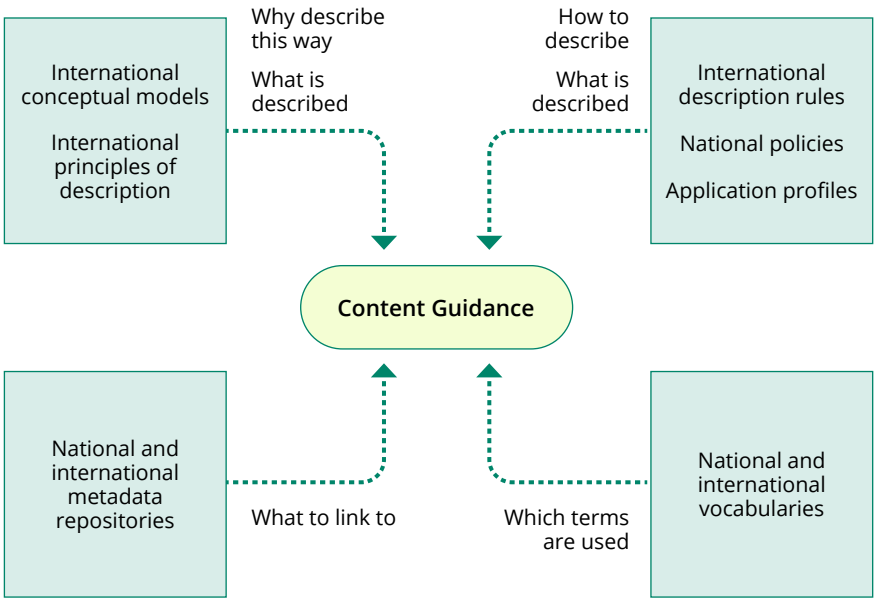

Figure 1: How and why is research data described? How is the process guided? (Image: Marja-Liisa Seppälä 2023, CC BY)

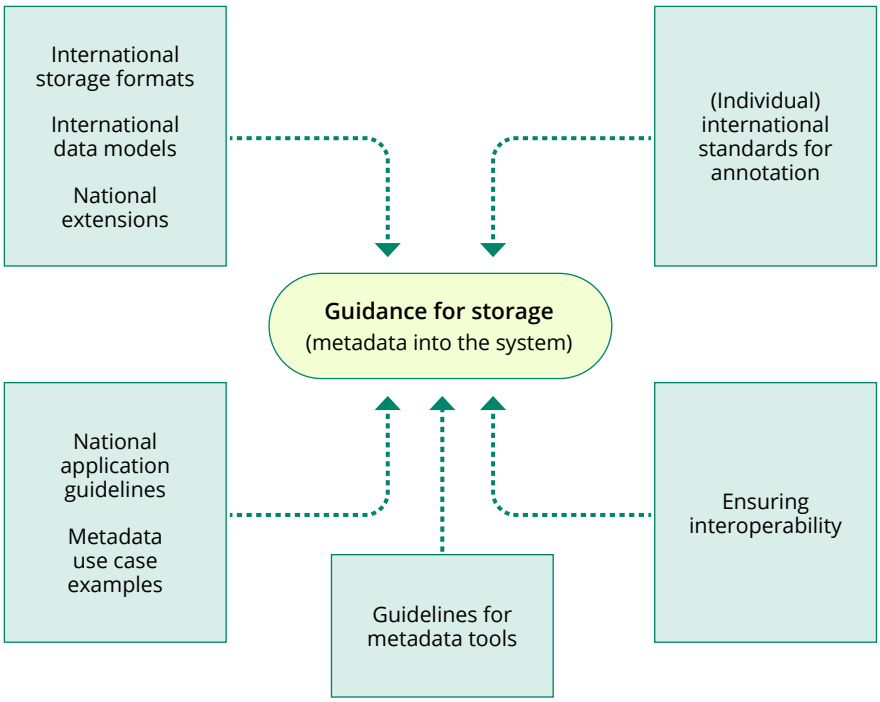

Figure 2: Principles guiding data deposition. (Image: Marja-Liisa Seppälä 2023, CC BY)

INTRODUCTION: DESCRIBING RESEARCH DATA AS AN INTEGRAL PART OF RESEARCH

Describing research data is an integral part of all research, regardless of whether the data can ultimately be made openly available. The process of data description creates a comprehensive understanding of the research context, methodology, and the data collected, along with its associated metadata. Thorough data description enhances research quality and facilitates assessment and constructive criticism. Moreover, it can open new opportunities for collaboration by providing view into the data for colleagues working on similar themes.

Data description is a continuous process throughout the research lifecycle. Researchers document, among other things, how the research was conducted, how the data was collected, and what were the key variables used. By continuously complementing research data description as the research progresses, opening the data and its description after the research is finalized require minimal extra effort. Immediate documentation also improves the accuracy and quality of the metadata.

DATA DESCRIPTION AND THE FAIR PRINCIPLES

The FAIR principles, first articulated in 2014, have become central to discussions on research data. FAIR stands for Findable, Accessible, Interoperable, and Re-usable, emphasizing that research data, methods, and outputs shall meet these criteria (see FAIR Principles https://www.go-fair.org/fair-principles/).

In short: the FAIR principles are realized through careful data description. Research data that is described in a detailed and comprehensible manner as well as adherent to disciplinary standards, and stored in a format conducive to technical reuse, is FAIR (see Keiski et al., 2023). Even if the data itself cannot be shared due to sensitivity or confidentiality concerns, descriptive metadata can almost always be made openly available. Open metadata increases the visibility of the researcher and the research data, even when the data remains closed. To enhance interoperability and reusability, it is crucial to store described data in machine-readable formats.

KEY ELEMENTS OF DATA DESCRIPTION – THE ROLE OF COMMON PRACTICES

Just as disciplines have established conventions for citing and referencing sources, they also have established practices for describing data. Practices in one field may not necessarily apply to another. Despite disciplinary differences, adhering to certain shared practices in data description is vital for ensuring data is findable, accessible, interoperable, and reusable across disciplines.

Table 1 summarises the key metadata elements applicable across disciplines. Most of these elements derive from widely adopted metadata standards such as DCAT and Dublin Core. Typically, the researcher involved in generating the data is responsible for creating most of these metadata elements. At the point of publication, repositories or archives provide the publication date and assign a persistent identifier in most cases. These repositories may also define the subject classifications or vocabularies used in content description.

Table 1. Key metadata elements for describing research data

Element	Description/Instructions	Related FAIR Principle	Data producer
Dataset Title	Provide a unique and descriptive title for the dataset 1) in the language of the dataset and 2) in English.	Findable	Researcher
Author & ORCID	Name the person or organisation responsible for creating the dataset, recorded in format "Last Name, First Name, Last Name2, First Name2". In addition to names, it is useful to use a unique identifier such as ORCID for disambiguation.	Findable, Accessible, Reusable, Interoperable	Researcher
Author's Affiliation	Specify the organisation to which the author is affiliated, including its code if available (e.g., organisational codes used in Research.fi).	Findable	Researcher
Owner	Indicate the owner(s) of the dataset. If the rights to the dataset have not been transferred to the organisation by an employment contract or other agreements (e.g. a project contract), the owners are the authors of the dataset. In addition to the names of the individuals, it is useful to use a unique persistent researcher identifier (e.g. ORCID). In addition to the name of the organisation, it is useful to use the organisation code.	Reusable	Researcher
Publisher	Name the entity (e.g., repository, archive or research performing organisation) authorised to publish the metadata OR metadata and data OR metadata and data documentation. In addition to the name of the organisation, it is useful to use the organisation code.	Findable, Accessible	Researcher
Funder	Describe the entity whose funds and resources were used in the creation of the dataset. In addition to the name of the organisation, it is useful to use the organisation code.	Findable	Researcher
Research Infrastructure	Indicate if the dataset was produced within a research infrastructure.	Interoperable, Reusable	Researcher
Description	Provide a concise summary (1–2 paragraphs) of the dataset's content. What is or has been studied with the data? What does the data consist of? What is the object of study and the unit of observation? When the descriptive data and/or the data to be described are published, the description must be informative enough to be understood and used by outsiders.	Findable, Reusable	Researcher
Method	Provide a brief description of the method(s) and software used to collect, compile and analyse the data. Depending on the type of data, give a brief description of the collection instrument and sampling method (e.g. measuring instrument, semi-structured interview, etc.).	Interoperable, Reusable	Researcher
Keywords	Select freely chosen descriptive words to enhance findability when the descriptive data and/or the data is published.	Findable	Researcher

Element	Description/Instructions	Related FAIR Principle	Data producer
Subject Headings	Use controlled vocabularies or ontologies (general or field specific) to find terms describing the subject that enhance findability when the descriptive data and/or the data is published. Examples of vocabularies: KOKO Ontology, YSO, MeSH.	Findable	Researcher
Discipline	Define the discipline(s) the dataset belongs to. Different repositories/archives use different classification systems. Example: the Ministry of Education and Culture's classification.	Findable	Archive/ Repository/ Publisher
Data Type	Describe the type of dataset, e.g., interviews, measurement data, physical samples, text, images, video, code, statistics. Use controlled vocabularies if possible, e.g. YSO.	Findable	Researcher
Language	Specify the language used in the dataset by using the three letter language code in ISO 639-2/3 standards, e.g., eng, fin, swe.	Findable, Accessible, Interoperable, Reusable	Researcher
Temporal Coverage	Describe the time span covered by the dataset. Use the ISO 8601 format YYYY-MM-DD. If necessary, document time in format HH:MM:SS	Findable, Interoperable	Researcher
Geographical Area Covered	Define the geographical area covered by the dataset. If possible, use a place name or coordinates according to the ISO standard or another machine-readable code, e.g. YSO places.	Löydettävä, yhteentoimiva	Tutkija
Version	If there are several versions of the dataset, mark the version clearly at file and folder level (e.g., v01.1).	Reusable	Researcher
File Format	Indicate the format in which the data is stored. If possible, use commonly used file formats that are independent of (commercial) software such as MS Office (e.g. .txt, .mp4). Try to use a controlled vocabulary, e.g. MIME types. Information on storage and transferable file formats for long term storage services.	Saavutettava, yhteentoimiva, uudelleenkäytettävä	Tutkija
Availability	Describe the availability of the finished material. If the material remains restricted or completely closed for a legitimate reason, describe this. If it is not possible to open the material, explain why it is not openly available. Examples of degrees of openness: 'Openly available online'; 'Available on request' and justification for restricted access; 'Available at metadata, documentation or dataset level by contacting the dataset owner' and justification for restricted access; 'Not available' and justification for keeping the dataset exceptionally closed. If the dataset is commercially available, describe how it can be purchased.	Accessible, Reusable	Researcher

Element	Description/Instructions	Related FAIR Principle	Data producer
Access Restrictions	If it is not possible to publish the material openly, please describe the justification for restricting access. The restriction request categories in the research data codes describe the justification for restricting access.	Accessible, Reusable	Researcher
License	The licence sets out the conditions under which the dataset may be re-used. Commonly used licences for text, images and tables are the Creative Commons 4.0 licences. For scripts, code and software, common ones include the GNU and MIT licences.	Reusable	Researcher
Related Datasets	Explain the relationship of the dataset to other data: 1) The data is derived from another data (IsBasedOn), 2) The data is part of another data (IsPartOf), 3) The data is related to other data (HasPart). Examples: 1) a follow-up data set where data collections are repeated, e.g. annually, 2) an image data set that is part of a larger multicomponent dataset, 3) a health survey that is divided into survey and interview datasets	Findable, Reusable	Researcher
Related Outputs	List possible publications or other outputs associated with the dataset.	Findable, Reusable	Researcher
Personal Data	If the dataset contains personal data, please describe: 1) the controller, 2) whether the dataset contains information on the participants in the study and/or on the persons appearing in the dataset belonging to special categories of personal data, and if so, what information.	Accessible, Reusable	Researcher
Confidential Information	Indicate if the dataset includes confidential information (e.g., trade secrets, sensitive ecological data).	Accessible, Reusable	Researcher
Publication Date	Please indicate the date of publication in the data archive or repository. Indicate the date in the ISO 8601 format YYYY-MM-DD. If necessary, the time can be given as HH:MM:SS.	Findable, Interoperable	Researcher
Retention Policy	Record the decision and a description of the plan to preserve the material permanently or for a specified period. Justify why this particular decision to preserve the material was taken, especially if the material is not to be preserved permanently. The researcher is responsible for the destruction of his/her data at the end of the retention period.	Accessible, Reusable	Researcher
Persistent Identifier	Assign your data a unique, permanent identifier. Repositories and archives where research data are stored often provide a permanent identifier such as DOI, URN or accession number.	Findable, Accessible, Reusable	Archive/ Repository/ Publisher

To guarantee interoperability and reusability, it is essential to include paradata in the dataset description. Paradata refers to information about how the research data was collected and processed. In line with good scientific practices, high-quality data description also includes proper attribution of authorship (TENK 2023). The scope of the dataset influences the level of detail in the description. Commonly used levels of description include:

- Entire dataset level (folder level),
- Folder structure level (subfolders),
- File level,
- Internal file structure level (e.g., variables), and
- Data content level (e.g., codings, annotations).

In some scientific disciplines, it is important that research can be repeated if necessary. Thorough documentation, conducted in accordance with the practices of the discipline, facilitates this replication process.

CHOOSING A REPOSITORY

A fundamental premise of data description is that the dataset or at least its metadata will be made available for future use. Responsibility for ensuring accessibility typically falls to repositories (examples are provided in Table 2). When selecting a suitable repository for their dataset, researchers should consult the guidelines of their discipline and institution. Adhering to these guidelines usually also ensures the machine-readability necessary for interoperability and reusability.

A reliable repository can most easily be identified by its CoreTrustSeal certification.

Table 2. Examples of data repositories

Discipline	Repository	Standard	Notes	Link
Multi-disciplinary	Zenodo	DataCite	Required fields: Publication date, title, authors, description, access rights, license	https://www.re3data.org/repository/r3d100010468
Multi-disciplinary	Figshare	DataCite	Required fields: Item title, item type, authors, categories, keywords, description, license	https://www.re3data.org/repository/r3d100010066
Multi-disciplinary	FAIRdata IDA Fairdata Qvain	Data stored in IDA is described in Qvain. FAIRdata Metax data model based on DCAT 3.0 is convertible to DataCite format Fairdata Metax data content in plain language	Preservation in IDA requires an active project. Usage right is granted to the organisation. Not for sensitive data. Descriptions in Qvain. Qvain is a description tool for data in IDA or archived elsewhere. Required fields in Qvain: License, dataset description and title, publication date, keywords, authors (person or organisation), publisher (personor organisation). Search portal for metadata available: Fairdata Etsin.	https://www.fairdata.fi/ida/ https://www.re3data.org/repository/r3d100012157 https://qvain.fairdata.fi/
Multi-disciplinary	Dryad	Dublin Core, DataCite, OAI-ORE, RDF DataCube	Required fields: Journal name; Title; Author(s); Abstract; Research domain; Keyword(s)	https://datadryad.org/stash/requirements
Biosciences and Environmental	Pangaea	Darwin Core, Dublin Core, ISO 19115, DIFF	Required fields: Event; Expedition; PI; Author(s); Data set title; Reference(s);Method; Abstract;	https://wiki.pangaea.de/wiki/Metadata
Biosciences	BOLD System	Multiple Standards	BOLD = Barcode of life data system. E.g., for photographs the required fields are: Image file; Original specimen; View metadata; Sample ID; License; License year; License contact.	https://www.boldsystems.org/
Medical Sciences	Multiple, see e.g. NIH-Supported Repositories	Multiple Standards	Multiple repositories for specific domains.	https://www.nlm.nih.gov/NIHbmic/domain_specific_repositories.html
Linguistics	Kielipankki	CLARIN Standards Information System	Information about a language resource to Kielipankki (Language Bank of Finland) of FIN-CLARIN Required fields: Information provider, email address of information provider, organisation, name of the language resource in Finnish and in English, type	https://www.kielipankki.fi/ https://www.re3data.org/repository/r3d100011807

Discipline	Repository	Standard	Notes	Link
All, especially Social Sciences, Humanities and Education	Finnish Social Science Data Archive	DDI (Data Documentation Initiative)	Aila portal for searching. The material is proposed to the Finnish Social Science Data Archive, which checks its suitability. Mandatory fields in the notification: name of the author or collector of the data, response to informing research subjects, name and brief description of the data, size of the data, name of the notifier, background organisation and email	https://www.fsd.tuni.fi/fi/ https://www.re3data.org/repository/r3d100010490
Multi-disciplinary/ Community-Specific	EUDAT CDI B2SHARE / EUDAT B2SHARE Premium	EUDAT Core and Extended Schema (based on DataCite Schema) and community-specific extension	EUDAT CDI B2SHARE is a free service with terms of use common to all. Community-specific customized schema extensions are also possible in the free service, e.g. for suitable joint projects. EUDAT B2SHARE Premium services are customised services for organisations, for which a fee is charged and where, among other things, storage capacity, metadata model and service functionalities can be customised as agreed with the customer. Mandatory fields (customisable for Premium services): https://schema.eudat.eu/eudatcore_metadataelements/	https://b2share.eudat.eu https://www.re3data.org/repository/r3d100011394 https://www.eudat.eu/catalogue https://docs.eudat.eu/b2share/overview/ An example of B2SHARE Premium service - The METIS service by the Finnish Meteorological Institute: https://www.re3data.org/repository/r3d100013582 https://fmi.b2share.csc.fi EUDAT CDI B2FIND service aggregates metadata from all B2SHARE services and other repositories of communities: https://b2find.eudat.eu

EXAMPLES OF DATASET DESCRIPTIONS

The following examples are retrieved from the Finnish Social Science Data Archive (Tietoarkisto). They are also available with corresponding descriptions in English (Alaterä, 2024).

Good quantitative examples include:

- National Election Study (https://urn.fi/urn:nbn:fi:fsd:T-FSD3467)
- Citizens' Pulse (https://urn.fi/urn:nbn:fi:fsd:T-FSD3826)
- Welfare and Inequality in Finland (https://urn.fi/urn:nbn:fi:fsd:T-FSD3539)

Good qualitative examples include:

- Finnish Experiences of Loneliness (https://urn.fi/urn:nbn:fi:fsd:T-FSD3609)
- Stories About My Dog's Life (https://urn.fi/urn:nbn:fi:fsd:T-FSD3724)

IN CONCLUSION: REMEMBER THESE KEY POINTS

It can be difficult for a researcher to describe the research data in isolation from the research results. It is hoped that this guide has clarified what data description entails and why it is important.

Data description is carried out during the research process, and public metadata is prepared when research data is published. Even if the dataset itself is not published, metadata should still be made publicly available.

The users of this manual should bear at least these things in mind:

1. Describing the research data is about what the data contains. Instead of describing the research and the results, the research data is described – how the data was collected, what the population is, how the data is organised, how much data there is, what the limitations of the data are, and so on.
2. If you don't know, ask! There are bound to be experts in your organisation who can, at the very least, guide the person asking for help.
3. Data description contributes to the dissemination and accessibility of scientific knowledge in civil society; scientific knowledge belongs to everyone.

CHECKLIST FOR PRACTICAL SUPPORT

a. Plan and develop practices for dataset description throughout the research process.
b. Choose a repository or metadata database and familiarise yourself with its requirements.
c. Use standards and consult field-specific guidelines for data description. Refer to the table of key metadata elements for essential fields.
d. Identify the metadata needed to ensure your dataset is understandable and usable after the research.
e. Be systematic in your description and documentation throughout the project.
f. Prepare public metadata and publish it (possibly alongside your dataset).

VOCABULARY

English Term	Description	Finnish term
Curation	Curation refers to the management of research datasets. This includes organising the data so that files are systematically and understandably named, folder structures are logically arranged, backups are made, and access to the dataset can be restricted if necessary. Curation also involves ensuring the quality of the dataset (e.g., addressing potential errors or missing data) and adding metadata to document the dataset comprehensively.	Kuratointi
Data Repository	A data repository is a digital archive designed for the storage and retrieval of research datasets. In addition to the dataset files themselves, metadata describing the dataset is stored in the archive. It is advisable carefully consider the choice of data repository (see the section on " Choosing a Repository").	Datarepositorio
FAIR Principles	The FAIR principles encompass the Findability, Accessibility, Interoperability, and Reusability of research data. Adhering to these principles improves the quality and impact of research by ensuring that metadata describing the dataset is easily discoverable in different databases. Describing the dataset in this way also helps the dataset collector return to it later. It is important to note that the FAIR principles also include the possibility of restricting access to research data if necessary.	FAIR-periaatteet
General Description	A general description is a full-text, human-readable narrative of a dataset's content, presented in a data repository. It is essential for discoverability and browsing, allowing users to quickly understand the contents of a dataset. The description provides key information about the dataset in a comprehensible form, acting as a 'business card' or 'elevator pitch' for the dataset.	(Yleis)kuvaus
Keyword	Keywords are free-form terms related to the content of a dataset, used to describe the dataset. They can refine and expand the description provided by controlled subject headings, offering more precise terminology specific to the research field. However, uncontrolled keywords may not always be unambiguous in broader contexts, as their meaning may vary between disciplines.	Avainsanat
License	A license defines the terms under which a dataset can be used. Even if a dataset is freely available, the license may impose restrictions on its further use.	Lisenssi
Long-term storage	Long-term storage involves maintaining datasets in a usable and discoverable form for decades or centuries. This requires detailed description of the dataset and storage in a format that will remain usable in the future.	Pitkäaikaissäilytys
Machine Readability	Machine readability refers to structuring data so that it can be processed by machines. For example, while PDF is human-readable, it is not machine-readable.	Koneluettavuus
Metadata	Metadata refers to information about a dataset. It typically includes the dataset's title, general description, keywords, and subject headings, details about the individuals or organisations involved in its collection, the publication date, version history, openness and access rights. References to other research data or a publication related to the data may also be included in metadata.	Kuvailutiedot (metadata, metatiedot)
Metadata Standard	A metadata standard provides a framework for structuring metadata consistently, for example, for a database. It defines how information should be collected and stored. Using different standards allows metadata to be adapted to better suit specific disciplines.	Metadatastandardi
Ontology	In the context of metadata, ontology refers to a structured system of terms related to a dataset, including their unambiguous meanings and relationships to other terms (e.g., broader and narrower concepts). Ontologies enable the association of terms with context in a form that is also understandable to information systems.	Ontologia

English Term	Description	Finnish term
Paradata	Paradata refers to information about the collection and processing of a dataset. It can be helpful for interpreting the dataset.	Paradata
Persistent Identifier (PID)	A persistent identifier is a reference that ensures a dataset remains findable even if its location changes. It is recommended to include a persistent identifier in the metadata so that it unequivocally links to the dataset. If the content of a dataset changes, a new persistent identifier must be issued. Persistent identifiers must be maintained to refer to a specific version of the dataset.	Pysyvä tunniste
Readme File	A Readme file is a free-form text file that documents metadata about a dataset. It is particularly useful when the chosen metadata standard is insufficient. A Readme file can also compile metadata for later entry into a data repository. Although it is a free-form file, it should be clear and comprehensible to facilitate understanding of the dataset.	Readme-tiedosto
Repository	A repository is a system that consists of the technical infrastructure and services for storing and maintaining access to scientific datasets.	Repositorio
Schema	See metadata standard	
Subject Heading	Subject headings are interconnected terms selected from a maintained and predefined vocabulary to describe a dataset. Using controlled subject headings enhances the discoverability of a dataset, as these vocabularies are designed to be unambiguous (synonyms refer to the same term) and include information about the context of use. Since controlled vocabularies are limited, it is advisable to complement their use with more free-form keywords.	Asiasanat

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Thanks

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