Research data management, a chance for Open Science. Methods and tutorials to create a Data Management Plan (DMP)

Marie Puren, Charles Riondet

Research data management, a chance for Open Science.

Methods and tutorials to create a Data Management Plan (DMP)

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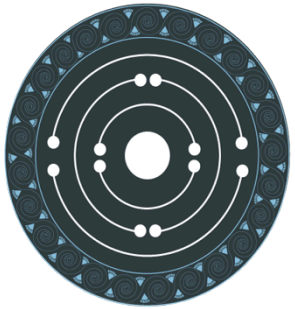


PARTHENOS

Pooling Activities, Resources and Tools for Heritage E-research Networking, Optimization and Synergies

Introduction

"Effective management of data promises rewards **throughout and beyond the life of a research project**. […] For the researcher, the perception of data as an instrument of research and new knowledge can be **transformational**. Well-managed data lead to **higher-quality research**, increased visibility and the consequent benefits of enhanced citation rates."

How to develop RDM Services, Digital Curation Center

Lesson Topics

- Open science
- The Research Data Management
- What are Data Management Plans (DMP)
- Components of a DMP
- Why prepare a DMP?
- How to make a DMP

Learning objectives

After completing this lesson, the participant will be able to:

- Define the Research Data Lifecycle
- Define a DMP
- Understand the importance of preparing a DMP
- Identify the key components of a DMP
- Create a DMP

What is research data?

- "Data are distinct pieces of information, usually formatted in a special way."
  (BU Libraries)

- Defining "research data" is challenging.

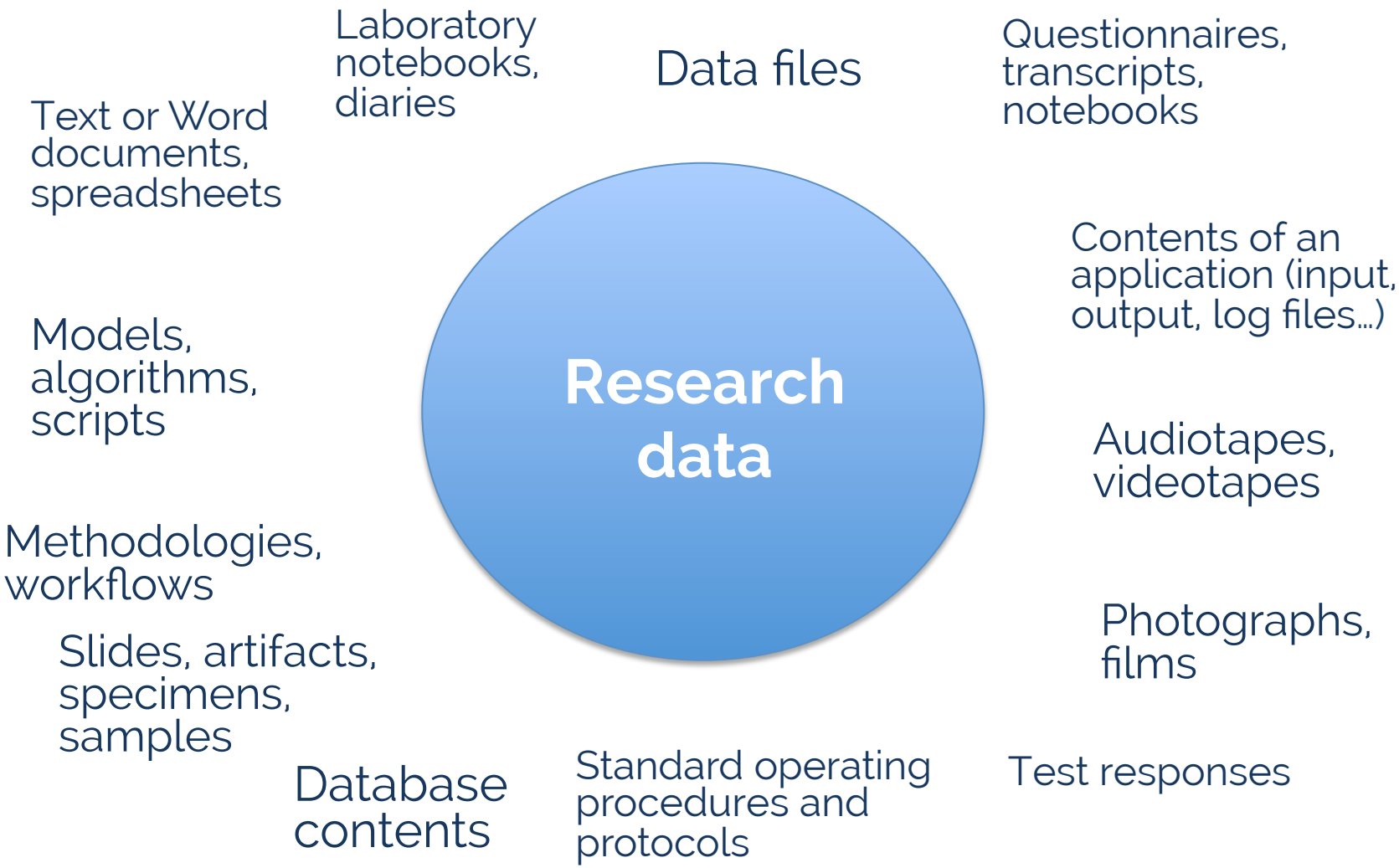
- BU Libraries: "Research data is data that is collected, observed, or created, for purposes of analysis to produce original research results."

What is research data?

Research data can be:

- Observational
- Experimental
- Generated from test models (simulation)
- Derived or compiled (like text and data mining)
- Reference or canonical (for instance, gene sequence data banks)

What is research data?



What is research data?

- Research data:
  - data that help to do research;
  - data that could be collected or created, then analysed;
  - data that come in multiple formats.

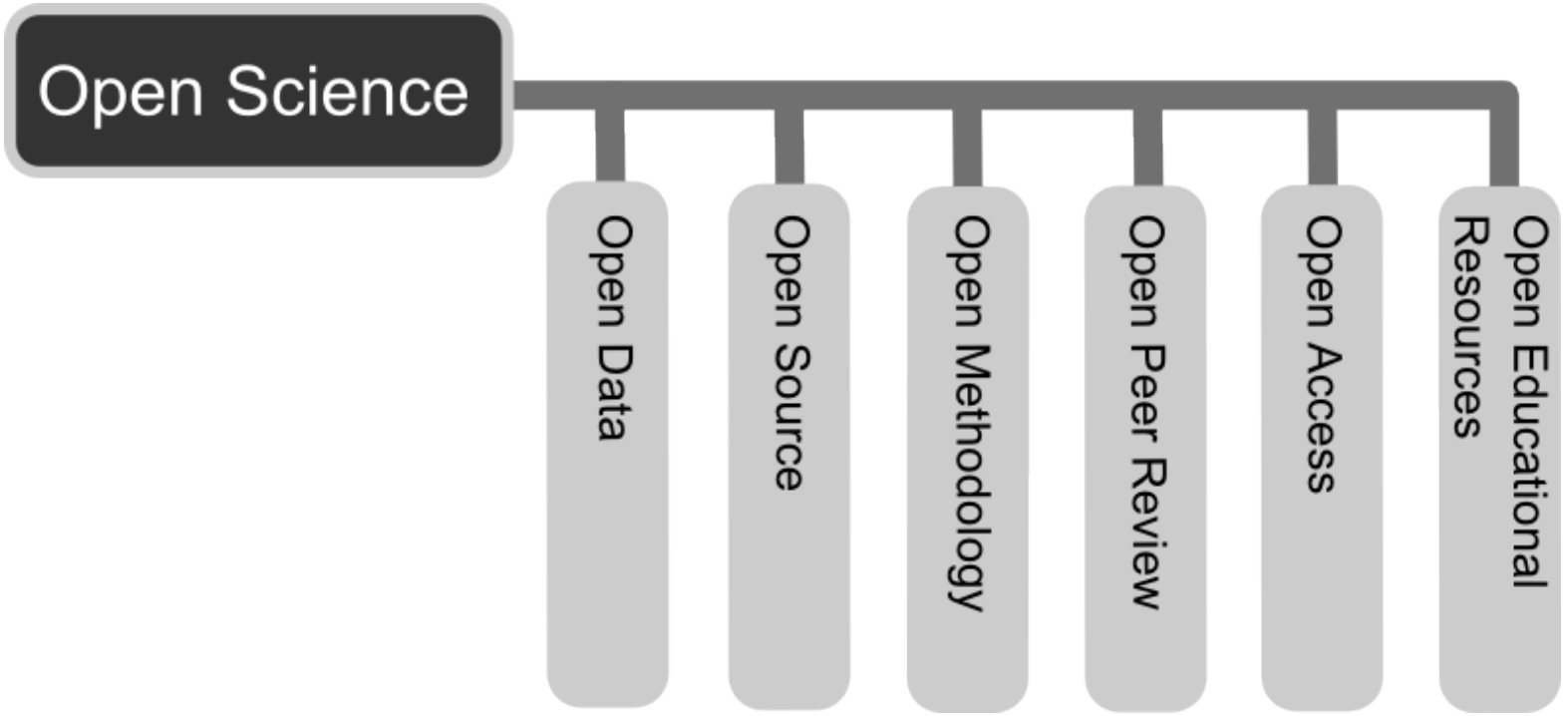
- Dataset: "might comprise a single element [...] [or] a collection of related elements."

  (Oxford Research Data Website)

A new model of openness for research data

- Availibility and access
- Re-use and redistribution
- Universal participation

A new model of openness for research data



By Andreas E. Neuhold, own work - based on "The taxonomy tree", FOSTER (Facilitate Open Science Training for European Research)

For more information on Open Science: Michael Nielsen, *Reinventing Discovery: The New Era of Networked Science*, Princeton University Press, 2011.

A new model of openness for research data

Open = "Anyone can freely access, use, modify, and share for any purpose."

Open Knowledge International, "The Open definition"

A new model of openness for research data

"It has become increasingly apparent that scientific data should be considered a product in much the same way jounal articles or conference proceedings are [...]."

Felicia LeClere, "Too Many Researchers Are Reluctant to Share Their Data", *The Chronicle of Higher Education*, 2010.

Supported by European and national initiatives

Horizon 2020 Research and Innovation Programme

The Pilot on Open Reseach Data (ORD Pilot)

"The ORD pilot applies primarily to the **data needed to validate the results** presented in scientific publications. **Other data** can also be provided by the beneficiaries **on a voluntary basis**, as stated in their Data Management Plans."

H2020 Programme Guidelines on FAIR Data Management in Horizon 2020, Version 3.0, 26 July 2016, p.3.

Supported by European and national initiatives

Extension of the ORD Pilot in July 2016

"The Commission has enabled access to and reuse of research data generated by Horizon 2020 projects through the Open Research Data Pilot (ORD Pilot). As stated in the 2017 work programme, the pilot is being extended to cover all thematic areas as described below. [...] By extending the pilot, open access becomes the default setting for research data generated in Horizon 2020."

H2020 Programme Guidelines on Open Access to Scientific Publications and Research Data in Horizon 2020, Version 3.0, 26 July 2016, p.8.

Supported by European and national initiatives

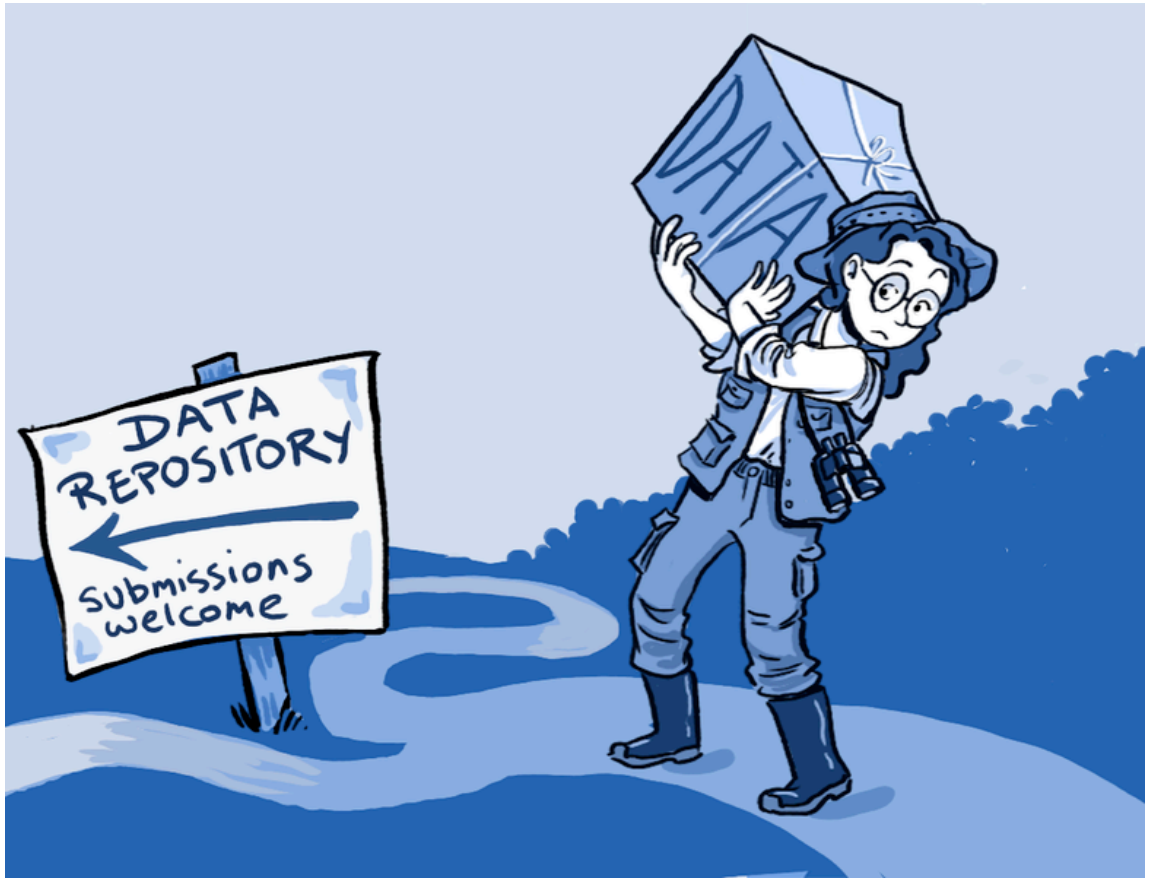
- United States:
  - *National Institutes of Health* (NIH) since 2003
  - *National Science Foundation* (NSF) since 2010
- United Kingdom:
  - *National Environment Research Council* (NERC), *Research Councils* and *Wellcome Trust* (2000-2010)
  - *Biotechnology and Biological Sciences Research Council (BBSRC) Data Sharing Policy* in 2007 (updated in 2010)
  - JISC (*Joint Information Systems Committee*) and *Digital Curation Center* (DCC) (2005)

Direct benefits for researchers

"Data sharing is a bit like going to the dentist. We can all agree that it is a good thing to do and intrinsic to good scientific practice. In reality, however, researchers tend to view data sharing with a mix of fear, contempt, and dread."

Felicia LeClere, "Too Many Researchers Are Reluctant to Share Their Data", *The Chronicle of Higher Education*, 2010.

Direct benefits for researchers



"To deposit or not to deposit, that is the question"

Roche DG, Lanfear R, Binning SA, Haff TM, Schwanz LE, et al. (2014) "Troubleshooting Public Data Archiving: Suggestions to Increase Participation", *PLoS Biol* 12(1): e1001779. doi:10.1371/journal.pbio.1001779

Direct benefits for researchers

1. Fulfill requirements
2. Increase your research impact and visibility
3. Save time
4. Preserve your data
5. Ensure higher quality data

Direct benefits for researchers

6. Promote innovation and potential new data uses
7. Maximise transparency and accountability
8. Support Open Access
9. Help less rich institutions and countries to do research
10. Make good science

Direct benefits for funders

1. Maximise return on investment
2. Reduce the cost of duplicating data collection
3. Have access to great resources for education and training

Sharing data

How can I do that?

Managing your research data
Why manage data?

For yourself:

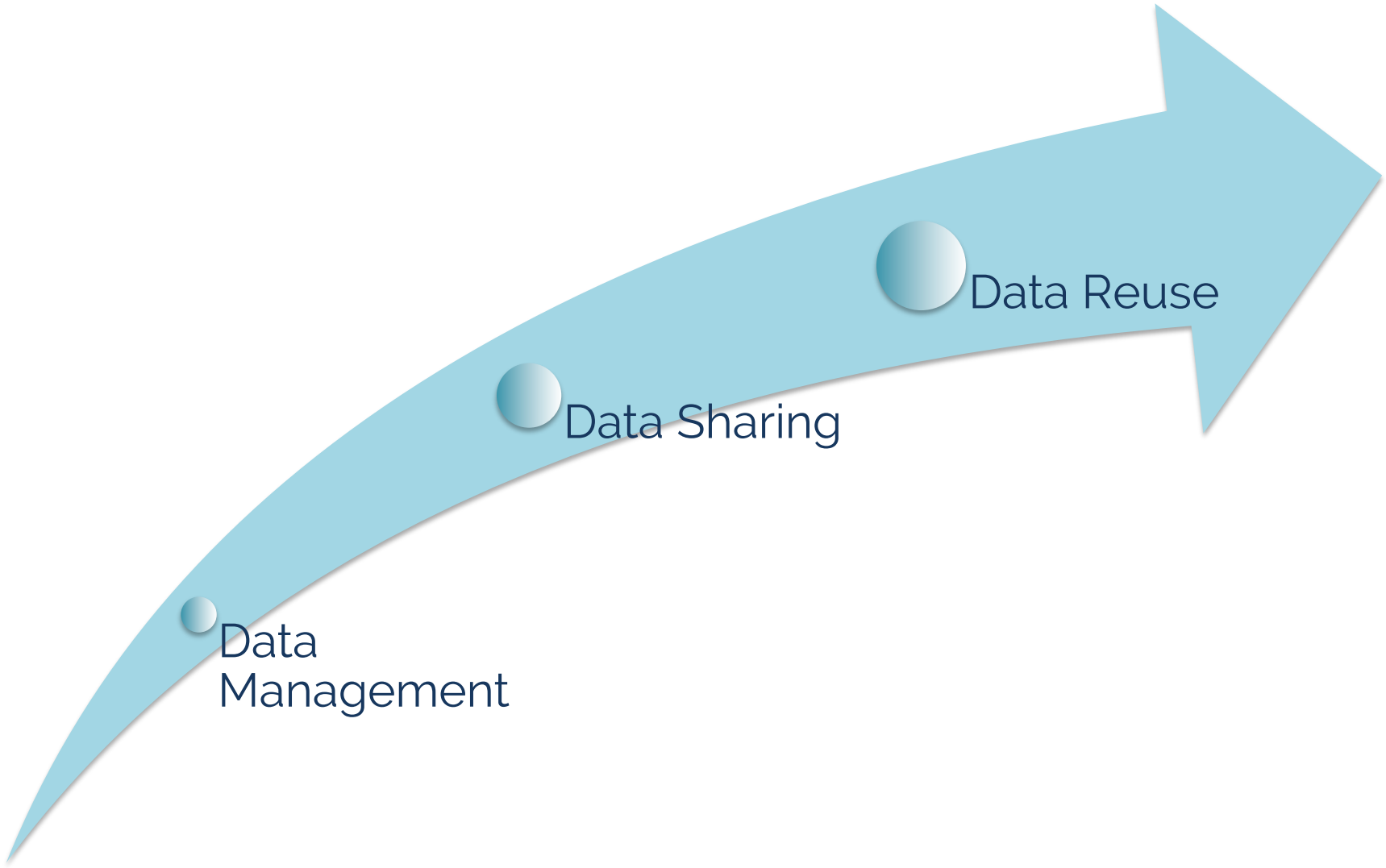
- Keep yourself organized: be able to find your files;
- Control the various versions of your data;
- Quality control your data more efficiently;
- Make backups to avoid data loss;
- Format your data for re-use (by yourself or others);
- Be prepared: document your data for your own recollection and re-use (by yourself or others).

Why manage data?

For funders:

- Maximize the effective use and value of data and information assets;
- Be assured that the quality of data is continually improved;
- Ensure appropriate use of data and information;
- Facilitate data sharing;
- Ensure sustainability and accessibility for re-use in science.

Why manage data?



Research data management (or RDM)

Definition

"Data management is integral to the process of conducting research."

University of Leicester, "When do you need to think about RDM"

During a research project, and after the project is complete:

- Collect,
- Organise,
- Manage,
- Store,
- Back up,
- Preserve,
- Share your data.

Research data management (or RDM)
Definition

"Good research data management is not a goal in itself, but rather the key conduit leading to knowledge discovery and innovation, and to subsequent data and knowledge integration and reuse."

Guidelines on FAIR Data Management in Horizon 2020, Version 3.0, 26 July 2016, p.3.

Research data management (or RDM)

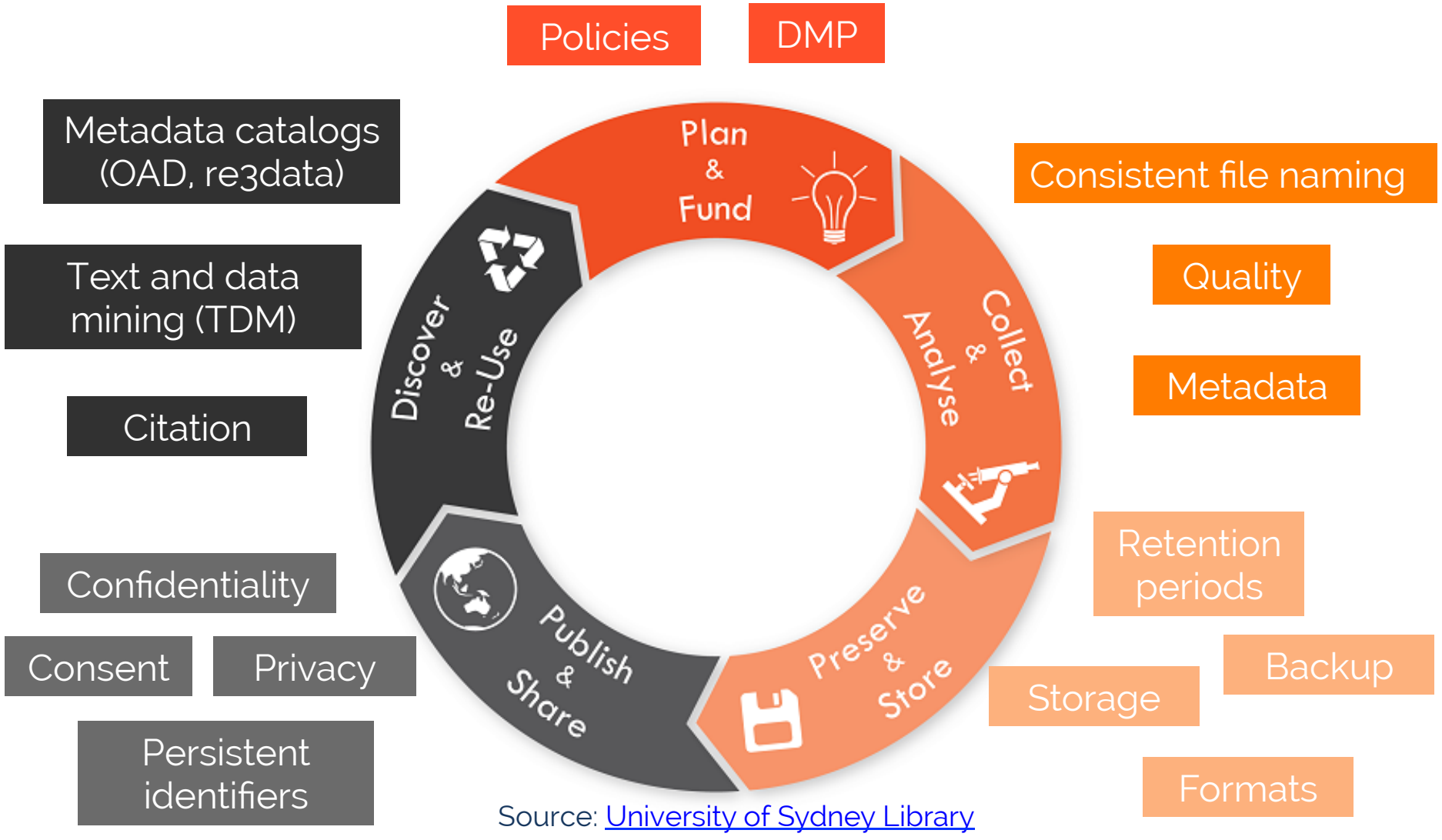
Definition

Research data management involves:

- Creating a **Data Management Plan** (or DMP);
- Storing research data;
- Depositing data in a long-term.

Research data management (or RDM)

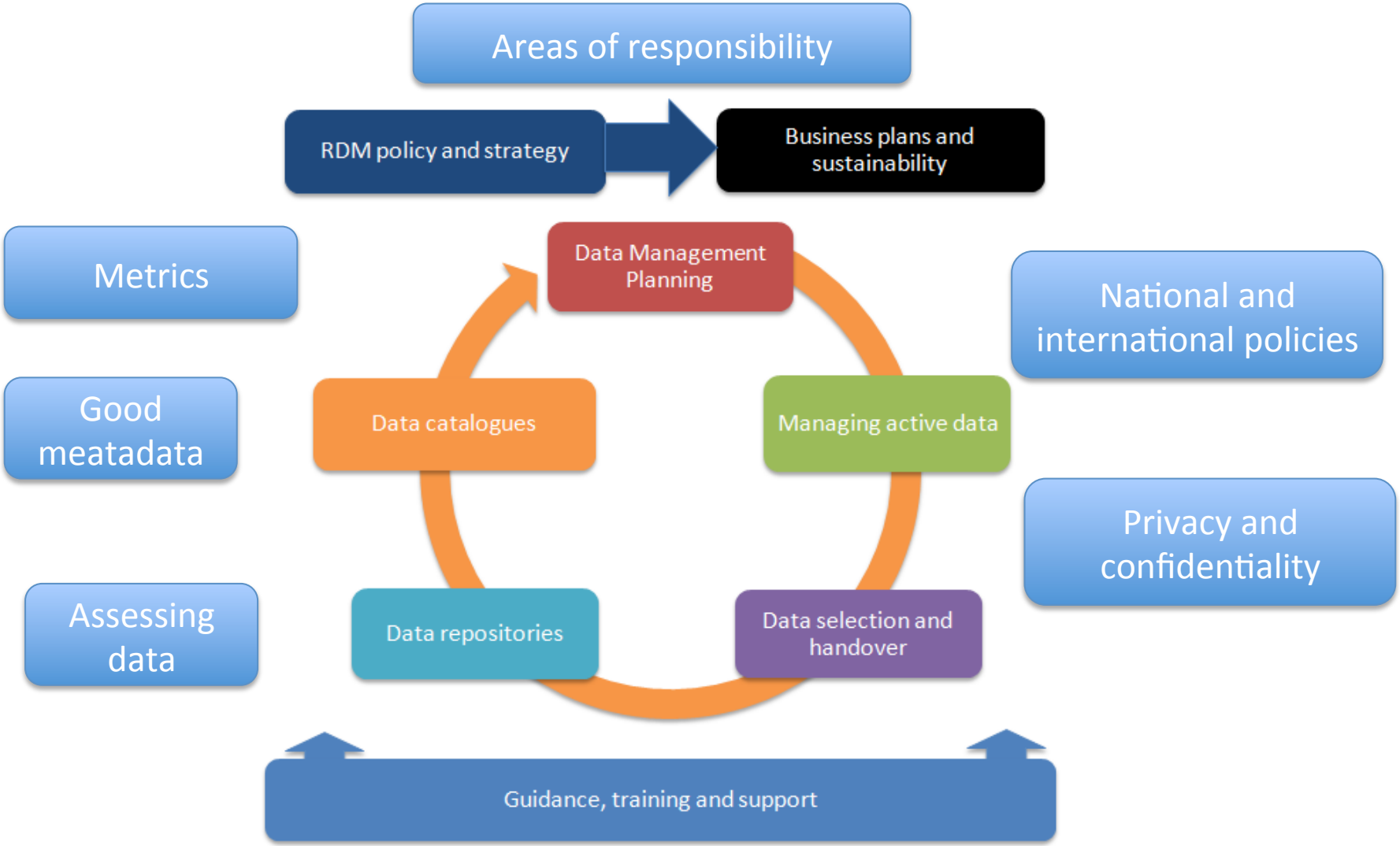
Research data lifecycle



Source: [University of Sydney Library]

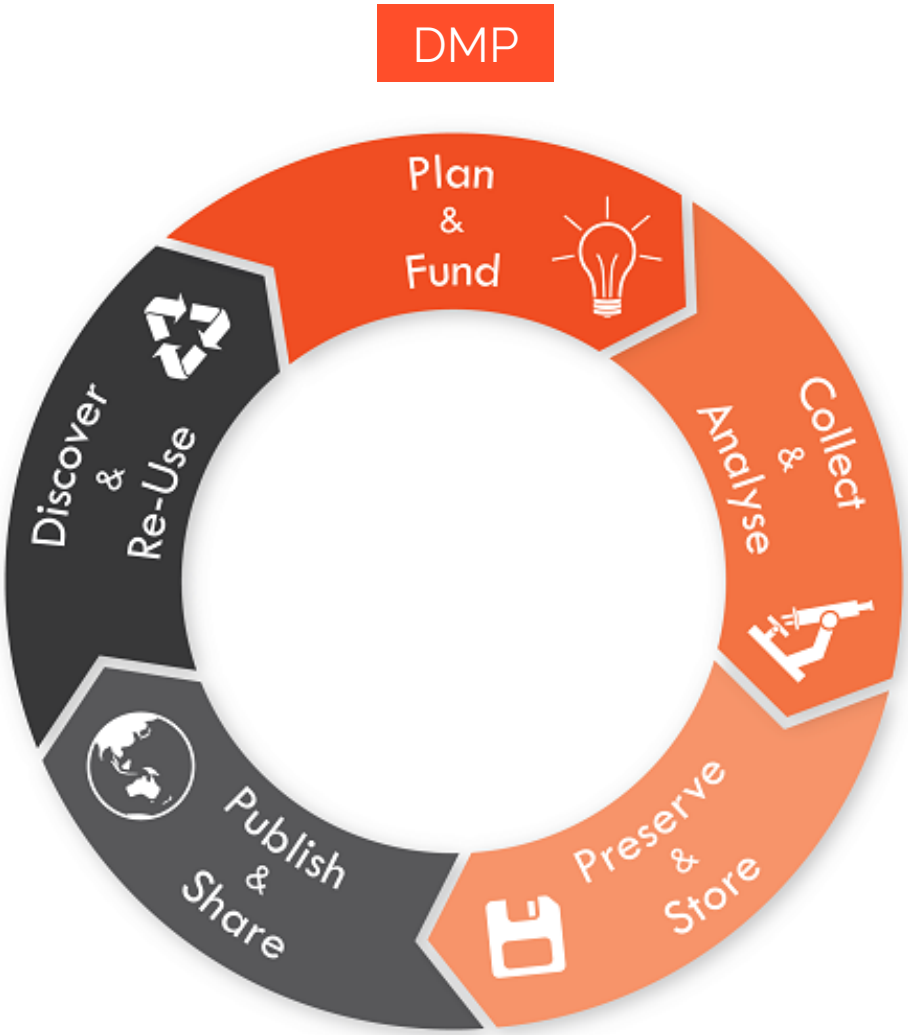
Research data management (or RDM)

Developing RDM services



Source: [Digital Curation Center]

Creating Data Management Plans (or DMPs)



Creating Data Management Plans (or DMPs)

Definition

"Data Management Plans (DMPs) are a key element of good data management. A DMP describes the data management life cycle for the data to be collected, processed and/or generated [...]."

H2020 Programme Guidelines on FAIR Data Management in Horizon 2020, Version 3.0, 26 July 2016, p.4.

Creating Data Management Plans (or DMPs)

Definition

A formal document that describes:

- the data you expect to acquire or generate during the course of a research project,
- how you will manage, describe, analyze, and store those data,
- what mechanisms you will use at the end of your project to share and preserve your data.

Creating Data Management Plans (or DMPs)

Definition

- A regularly updated roadmap;
- A standardised document;
- Its content varies depending on projects' requirements and funding agencies' requests;
- Focus on data and datasets collected, created, analyzed.

Creating Data Management Plans (or DMPs)

Definition

Deliverable of the project, but not a "technical" document

- It materializes the data policy of a project;
- It sums up goals and actions that will be implemented;
- It meets funder's requirements.

Creating Data Management Plans (or DMPs)

Why make DMPs?

The main stage of the RDM

Active "management" of digital data (=> the "M" in DMP):

- An ongoing maintenance;
- An action plan in terms of data quality, technical feasibility and financial viability.

Creating Data Management Plans (or DMPs)

Why make DMPs?

The main stage of the RDM

Data management ≠ Data stewardship

=

Optimizing resources for a specific purpose

- Identifying and making visible the actions to be conducted;

- Planning key stages, deadlines and critical time periods.

Creating Data Management Plans (or DMPs)

Why make DMPs?

The main stage of the RDM

Active management and digital curation

"Data curation activities enable data discovery and retrieval, maintain data quality, add value, and provide for re-use over time. This new field includes representation, archiving, authentication, management, preservation, retrieval, and use."

Digital Humanities Data Curation

Creating Data Management Plans (or DMPs)

Why make DMPs?

The main stage of the RDM

Digital curation ≠ Data storage

"Data storage is confined to simply keeping data in existence and ensuring that it can be accessed when needed. It does not necessarily entail **practices of refreshment or format migration** (essential to maintaining the data in a usable form) nor does it entail higher-level curatorial practices such as **enhancement of the data through added metadata, or migration from one representational standard to another**. Data curation thus goes far beyond the scope of data storage."

Digital Humanities Data Curation

Creating Data Management Plans (or DMPs)

Why make DMPs?

FAIR Data

A DMP "helps Horizon 2020 beneficiaries make their research data findable, accessible, interoperable and reusable (FAIR) […]."

H2020 Programme Guidelines on FAIR Data Management in Horizon 2020, Version 3.0, 26 July 2016, p.3.

Creating Data Management Plans (or DMPs)

Why make DMPs?

FAIR Data

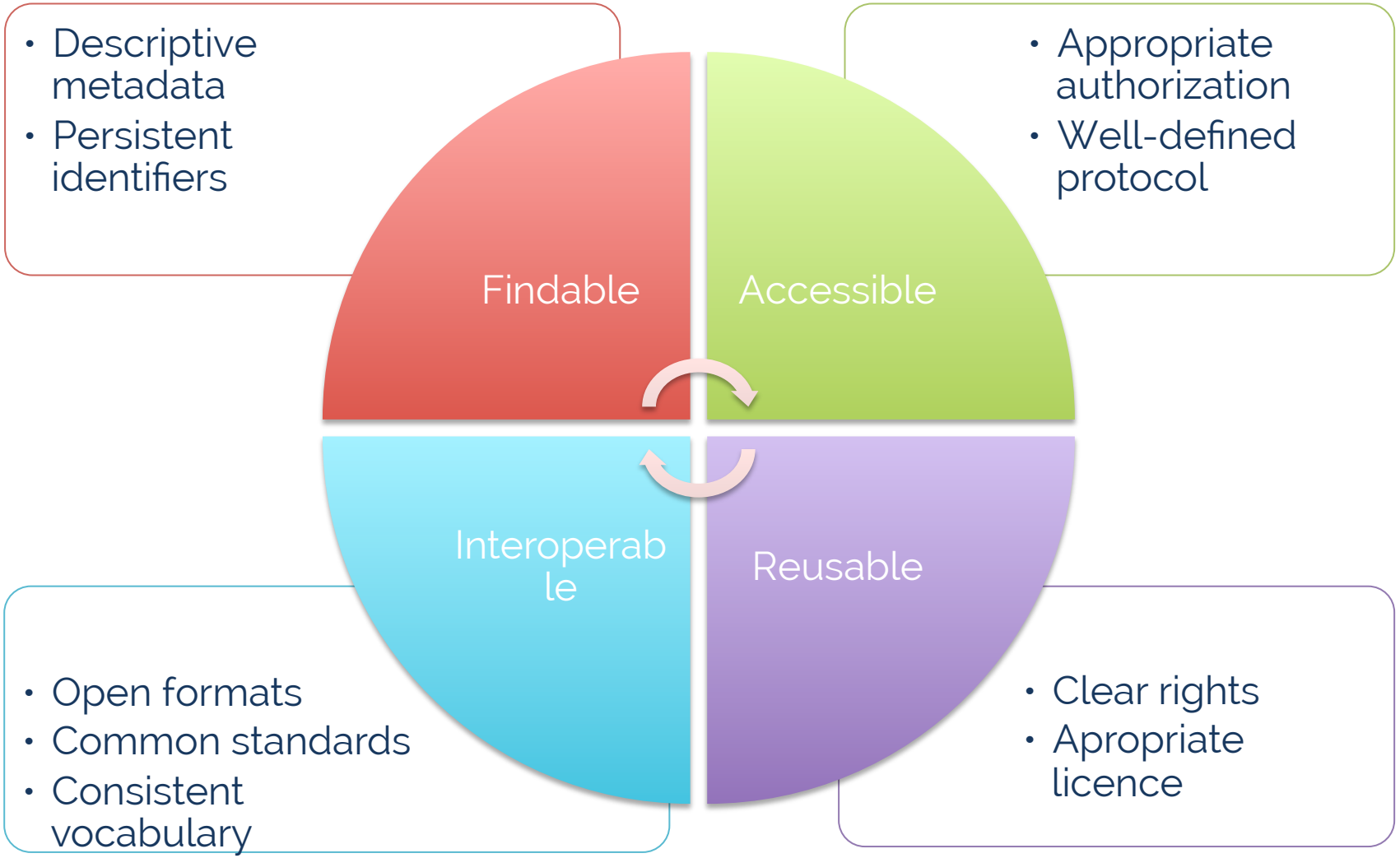
- January 2014: meeting organized by the Netherlands eScience Center and the Dutch Techcentre for the Life Sciences (DTL) at the Lorentz Center in Leiden

- **FAIR principles**: "data providers and data consumers - both machine and human - could more easily discover, access, interoperate, and sensibly re-use, with proper citation, the vast quantities of information being generated by contemporary data-intensive science." (Force 11)

Creating Data Management Plans (or DMPs)

Why make DMPs?

FAIR Data



Creating Data Management Plans (or DMPs)

Why make DMPs?

To comply with funders' requirements
H2020 framework

- First version of a DMP (deliverable): **first six months** of the project
- At the research proposal stage: providing a **short outline** of the data management policy.
- Since July 2016: **all the Horizon 2020 funded projects** have to provide a Data management Plan.

Creating Data Management Plans (or DMPs)

Why make DMPs?

To comply with funders' requirements
H2020 framework

Minimal requirements (initial DMP):

- A **description of data** to be generated or collected;
- The **standards and metadata** that will be used;
- The **data sharing**;
- The **archiving and preservation** (FAIR principles).

Components of a DMP

1. Information about data & data format
2. Metadata content and format
3. Policies for access, sharing and re-use
4. Long-term storage and data management
5. Budget

Crucial points to address

- Responsibility
- Results management
- Back up plan
- Intellectual property rights
- Becoming of the data after the project

Responsibility

Who does what and when?

Creates and describes the data

Hosting, security, …

Data selection, standards, mappings, …

Information about the data // Data Collection

What data will you use?

- Reused (Cite the source)
- Created

Characterization of the data

- Raw data, derived data?
- Purpose of the data
- Volume estimation
- Type: quantitative, qualitative, survey data, experimental measurements, models, images, audiovisual data, samples, etc.

Processing of the data

Technical details on the operations that will be performed

Information about the data // Datasets management

For each dataset, the DMP should give minimal information:

- Reference & name (Identifier for the dataset to be produced.)
- Description
  - Description of the data that will be generated or collected,
  - its origin (if collected),
  - nature & scale,
  - whether it underpins a scientific publication.
  - to whom it could be useful,
  - Information on the existence of similar data and the possibilities for integration & reuse.
- Which formats/standards are used for this data?

Datasets management: Things to avoid

File naming :

- Incomprehensible names

myFile_fdslkfskjf_lol(23).txt

- Unknown or variable naming rules

DB-backup-20october2016.txt

database-save-20161109.txt

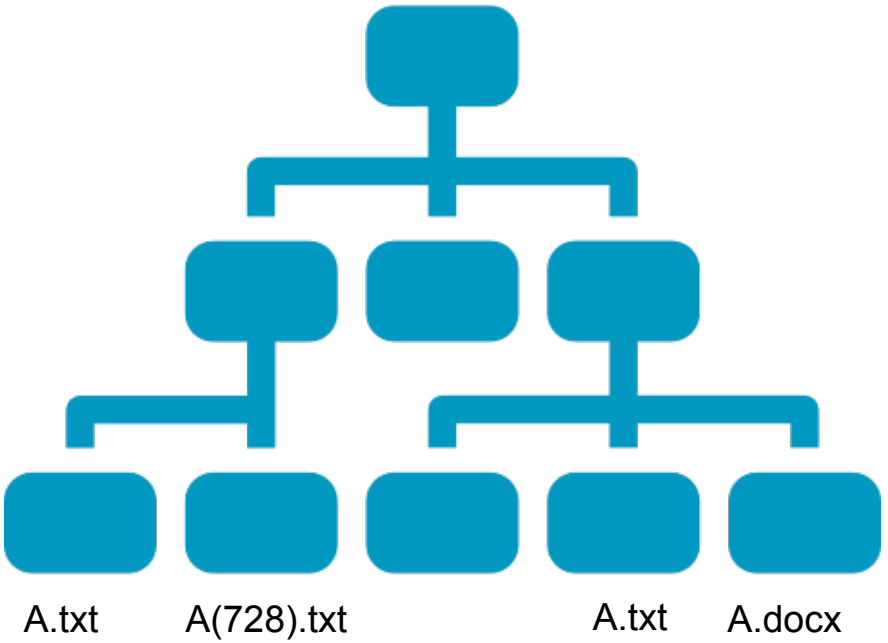
- Special characters

/</?.txt

Datasets management: Things to avoid

Files stored

- in several places
- in several formats and versions
- in proprietary formats

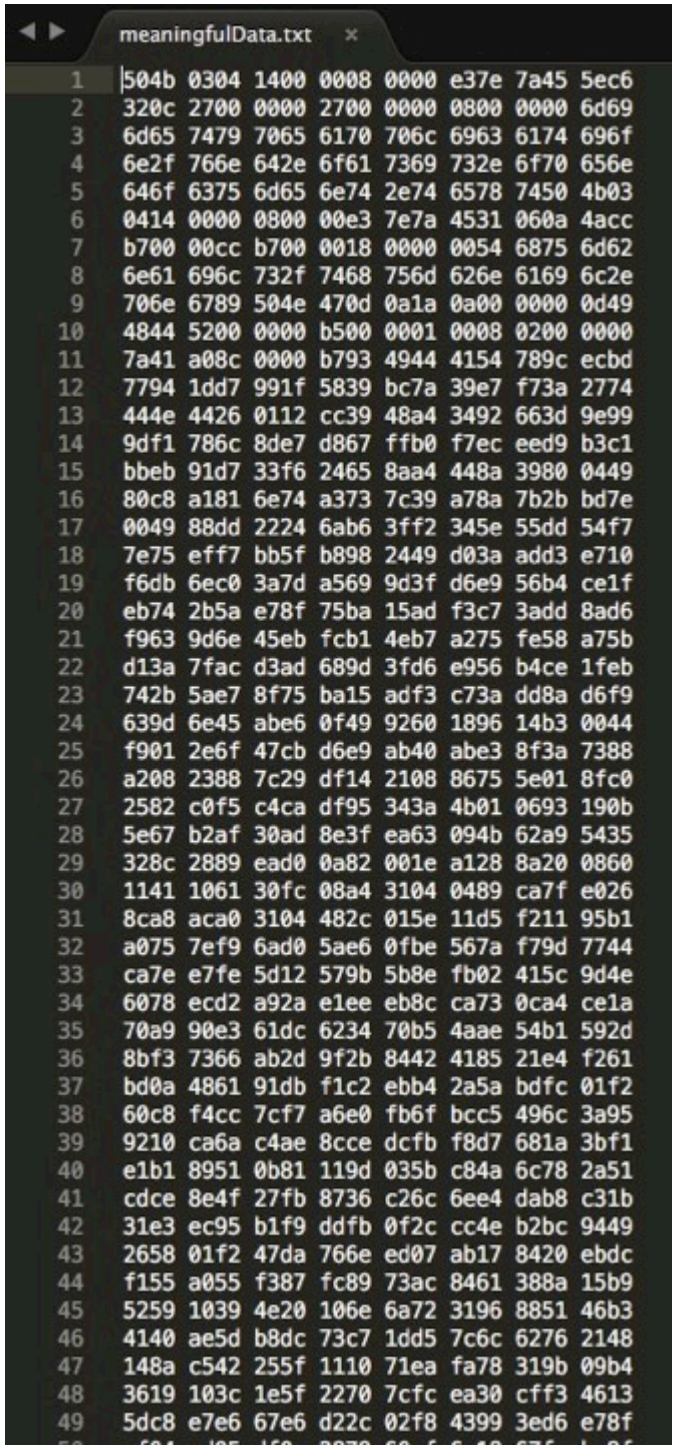


Data collection : Take-home message

- Formats
- Quality control process (How you will be sure that the created data is complete and accurate)
- Cite existing data you use
- Short term data management
- Identify Responsibilities for each task

Description and metadata

Big question : Is the data understandable by an outside researcher?



Documentation and Metadata

Metadata to describe your datasets

- Put a context around the resource : Information about the data creation (who, when, why, how) and its use (where are they stored and what are they used for)
- Machine readable
- Standardized: DublinCore, DataCite Metadata Schema
- Automatically or manually captured
- Stored in databases, text files, or as headers in your files (Cf teiHeader)

+ Document your practices

- The vocabularies used to describe the data
- If you use standards or home made format
  for your data.
- The terms definitions and any intern conventions
  for description and indexation

Example : DataCite metadata standard

Datacite is a consortium of several libraries and research institutes that provide Persistent identifiers (DOIs) for research data and a metadata format to describe them.

Main fields:

- Identifier
- Creators
- Titles
- Publisher
- Publication Year
- Resource type
- Format
- Subjects
- Languages
- Version
- description

Formats

Simple equation:

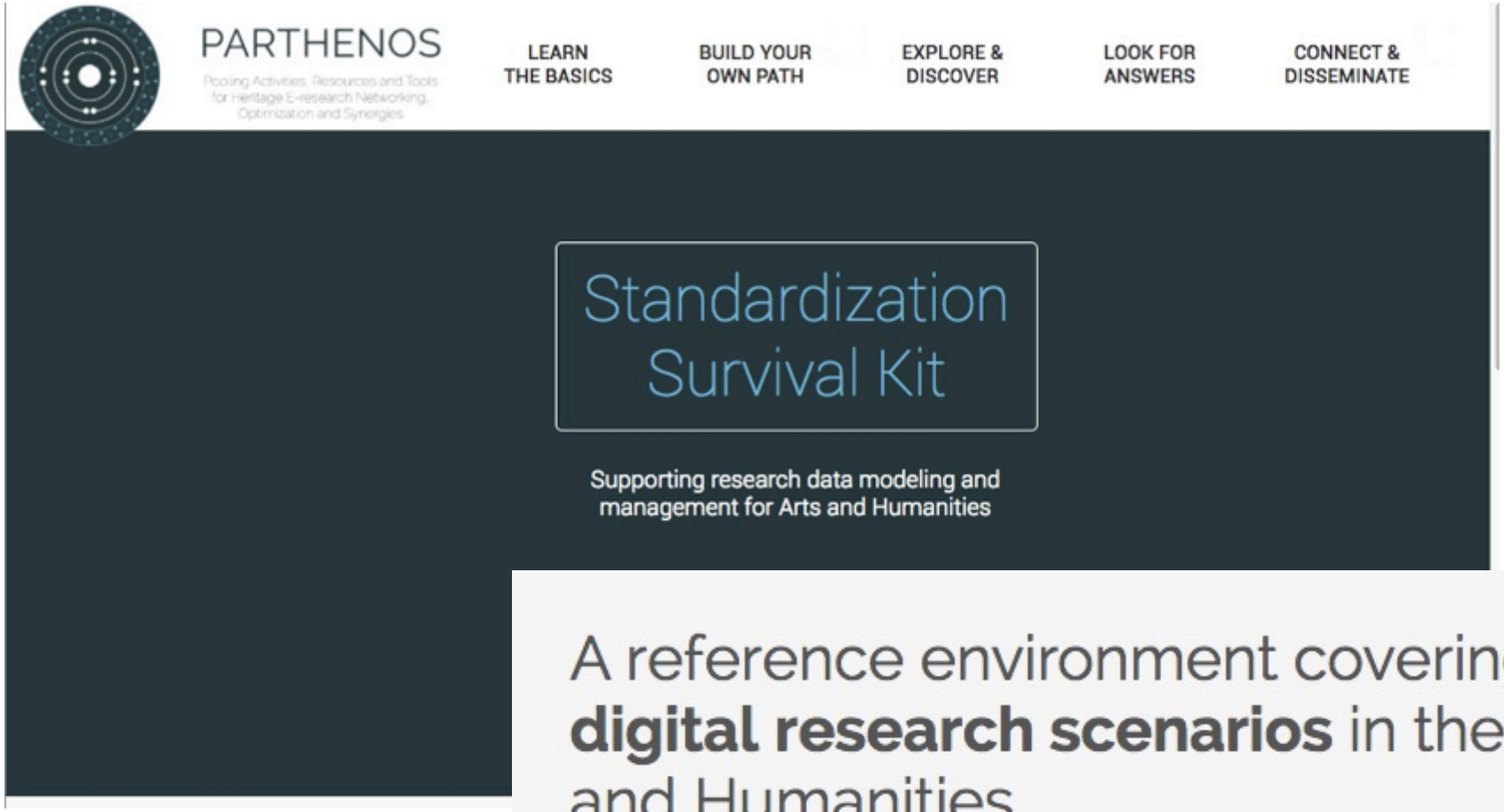
Open

\+ Interoperable

\+ Well spread in your research community

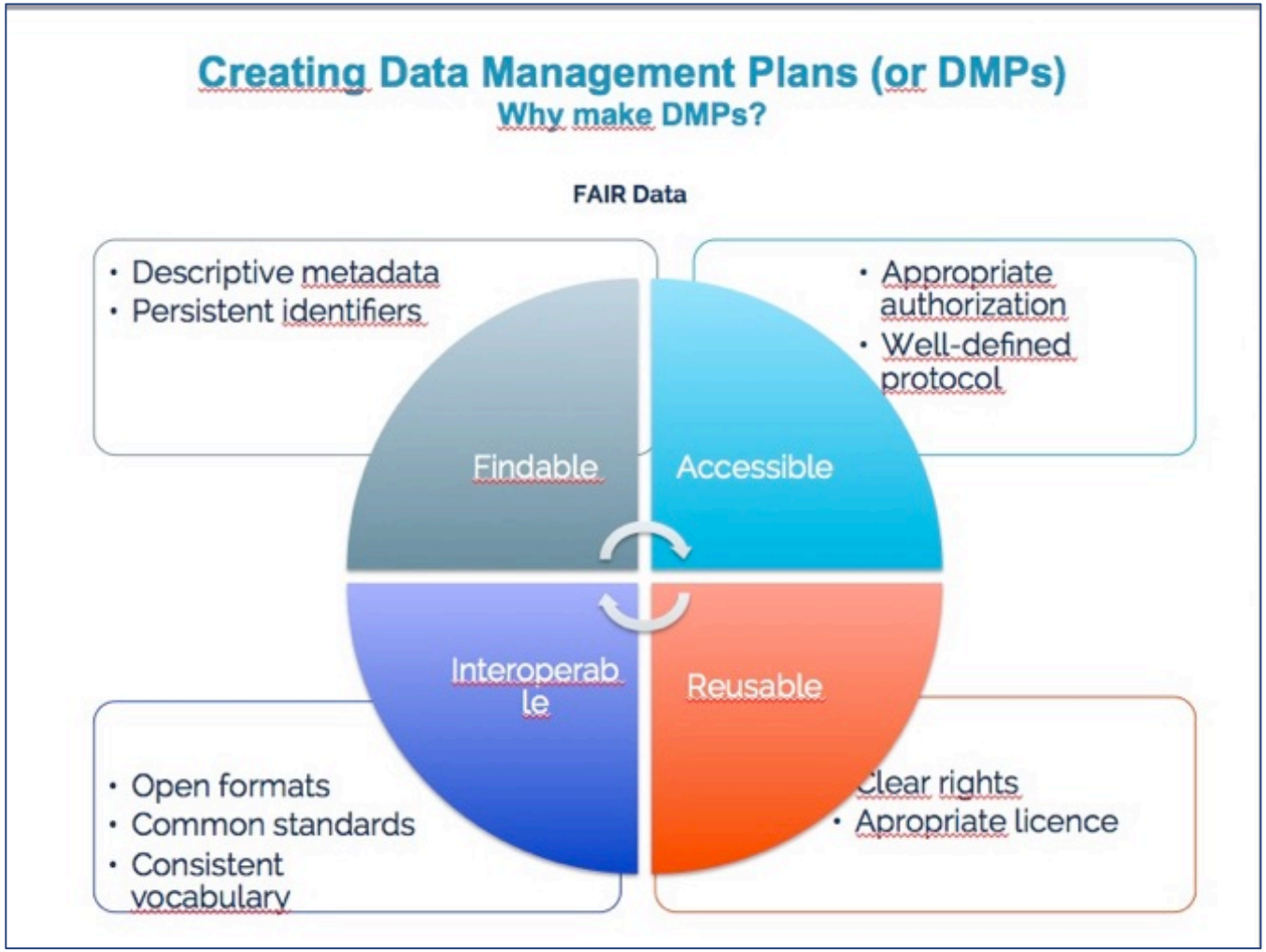
STANDARD

Coming soon: The Parthenos Standardization Survival Kit


PARTHENOS
Pooling Activities, Resources and Tools for Heritage E-research Networking, Optimization and Synergies
LEARN THE BASICS
BUILD YOUR OWN PATH
EXPLORE & DISCOVER
LOOK FOR ANSWERS
CONNECT & DISSEMINATE
Standardization Survival Kit
Supporting research data modeling and management for Arts and Humanities
A reference environment covering digital research scenarios in the Arts and Humanities
It provides you with reference material about standards and their use, such as bibliographic sources, available documentation or transformations tools.
The research scenarios gathered here will serve you as examples to give you some insight on how to use standards in your own similar project.

Formats and standards: Take-home message

Remember this slide?



Storage and Backup

How will the data be stored and backed up during the research?

- Anticipate incidents
- Who is responsible?

How will you manage access and security?

- If sensitive data (personal), adopt appropriate security measures

Questions : Where? Frequency of backups? How many copies? How many server space? Crypting? Costs? Restoring plans?

Storage = Budget + anticipation

Selection and Preservation

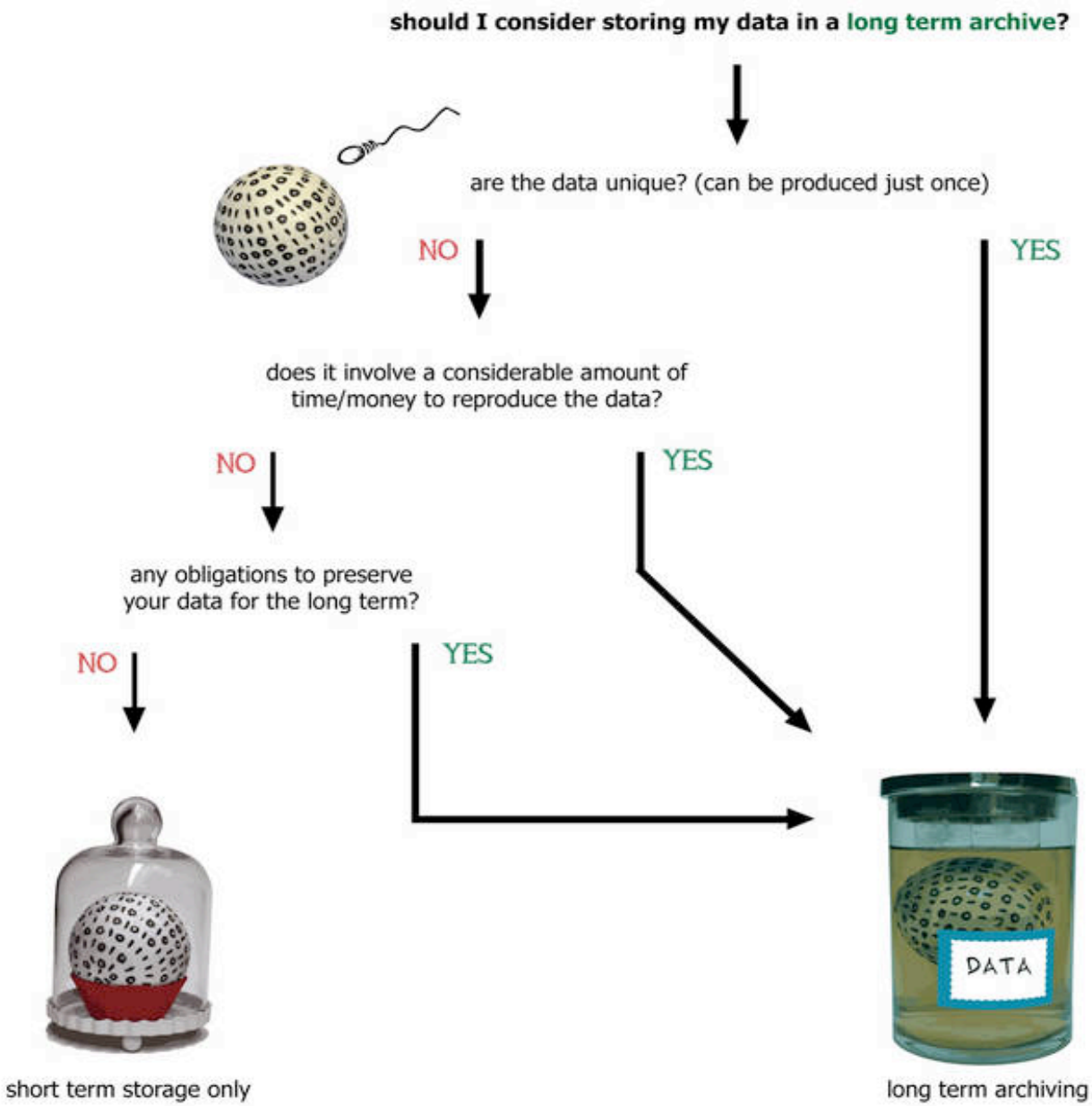
Which data are of long-term value and should be retained, shared, and/or preserved?

Some selection criteria:

- Anticipate the futures uses and reuses
- Legal or policy aspects
- Potential value
- Consider the ratio cost/benefit

Preservation of the datasets and also the associated metadata, the software and algorythms used.

The European Code of Conduct for Research Integrity demands to archive primary and secondary data for a « substantial period » (European Science foundation, 2011



Preservation (+ sharing): Data repositories

- Make data available for reuse (Harvesting, API, …)
- Citability
- Visibility
- Transparency
- Links to papers
- Preservation

Trusted repositories

Data seal of approval

Storage & preservation: Take-home message

Storage → budget

Preservation → sharing

Data access and sharing

Description of how data will be shared,

- access procedures
- embargo periods (if any)
- outlines of technical mechanisms for dissemination & necessary software and other tools for enabling re-use
- definition of whether access will be widely open or restricted to specific groups.
- Identification of the repository where data will be stored, if already existing and identified, indicating in particular the type of repository (institutional, standard repository for the discipline, etc.).

If the dataset cannot be shared, give the reasons why (e.g. ethical, rules of personal data, intellectual property, commercial, privacy-related, security-related)

Ethics and intellectual property rights

Who are the right holders ? For which data?

How will you manage any ethical issues?

- Consent
- Privacy
- sensitive data

Licensing : take into account the funder policy.

Consequences on long time preservation: For example, patents data should be stored indefinitely

Sharing

- Underlying data of a scientific paper
- Data paper
- Research data repository
- Project website

"Where possible, contributors should also be uniquely identifiable, and data uniquely attributable, through identifiers which are persistent, non-proprietary, open and interoperable (e.g. through leveraging existing sustainable initiatives such as ORCID for contributor identifiers and DataCite for data identifiers)."

Guidelines on Open Access to Scientific Publications and Research Data in Horizon 2020 (https://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/oa_pilot/h2020-hi-oa-pilot-guide_en.pdf)

Data papers

http://booksandjournals.brillonline.com/content/journals/24523666

Journal of
open archaeology data

http://openarchaeologydata.metajnl.com/

A datapaper is a scientific publication whose main goal is to describe a dataset or a group of datasets, more than analysis or research results, and to give access to the described data.

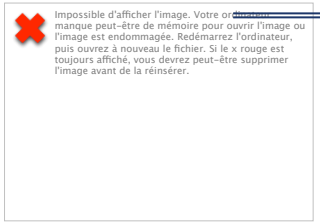
Coming soon (2) : Share your data using the…

CULTURAL HERITAGE

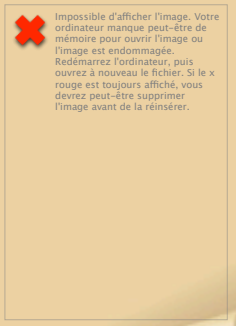
DATA RE-USE

CHARTER

CULTURAL HERITAGE DATA RE-USE CHARTER



Making Cultural Heritage Data easier to access, more sustainable, reproducible and citable.



Offering a comprehensive framework

including all aspects relevant to Cultural Heritage data re-use

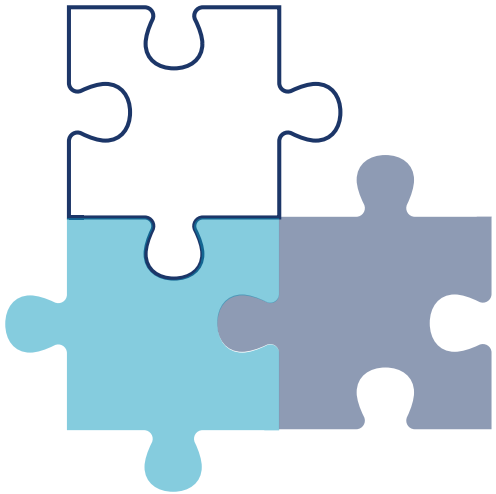
Supporting collaboration

between all those working with and on digital data originating from Cultural Heritage Institutions

Which digital data?

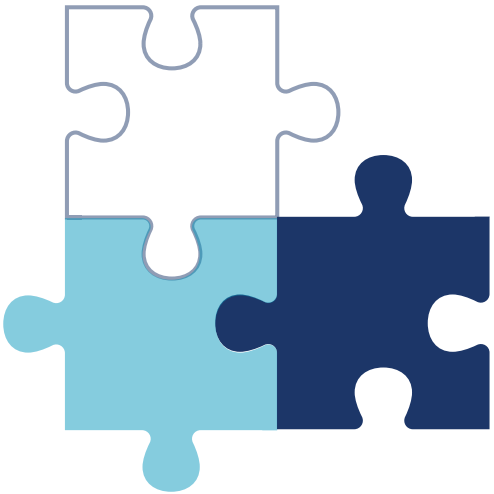
CULTURAL HERITAGE
DATA RE-USE
CHARTER

Impossible d'afficher l'image. Votre ordinateur manque peut-être de mémoire pour ouvrir l'image ou l'image est endommagée. Redémarrez l'ordinateur, puis ouvrez à nouveau le fichier. Si le x rouge est toujours affiché, vous devrez peut-être supprimer l'image avant de la réinsérer.



CULTURAL HERITAGE
DATA RE-USE
CHARTER

For which actors?



Which benefits?

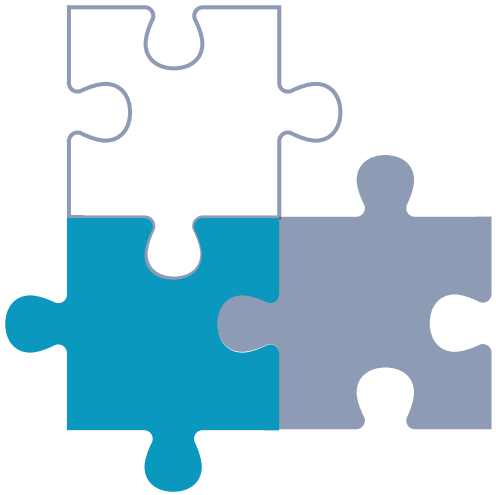
CULTURAL HERITAGE
DATA RE-USE
CHARTER

1. ***Register*** according to your personal or institutional profile

2. ***Get in touch*** with the cooperation partners and collections relevant to your activities

3. ***Gather information*** on relevant topics such as licensing

4. ***Gain visibilty*** and recognition in the international research ecosystem



IPR and sharing: take-home message

Open Data Citation for Social Sciences and Humanities

The companion blog to DARIAH's Humanities at Scale Winter School in Prague: 24th-28th October 2016

To sum up

Making a DMP is defining how the data, within a project, will be

- **Described**
- **Shared**
- **Protected**
- **Preserved**

A DMP contains:

- A data lifecycle description (including long term preservation)
- A data description
- A description of the data policy
- The associated costs

A DMP helps at secure and perpetuate data.

Very strategic, but not technical

To sum up : When and why?

When?

Before the first data are created

Regularly updated

Why?

Funders wants it

Research good practice

Who?

Team work

To sum up: A research good practice

Formalize inside a unique document a set of elements and informations useful for the project monitoring and for a good management of the results.

- Understand the data
- Long-term research is easier
- No work duplication
- Underlying data is more accessible
- Research more visible : better citabilty

DMP for PHDs

PHD candidates can profitably create a DMP for the same reasons

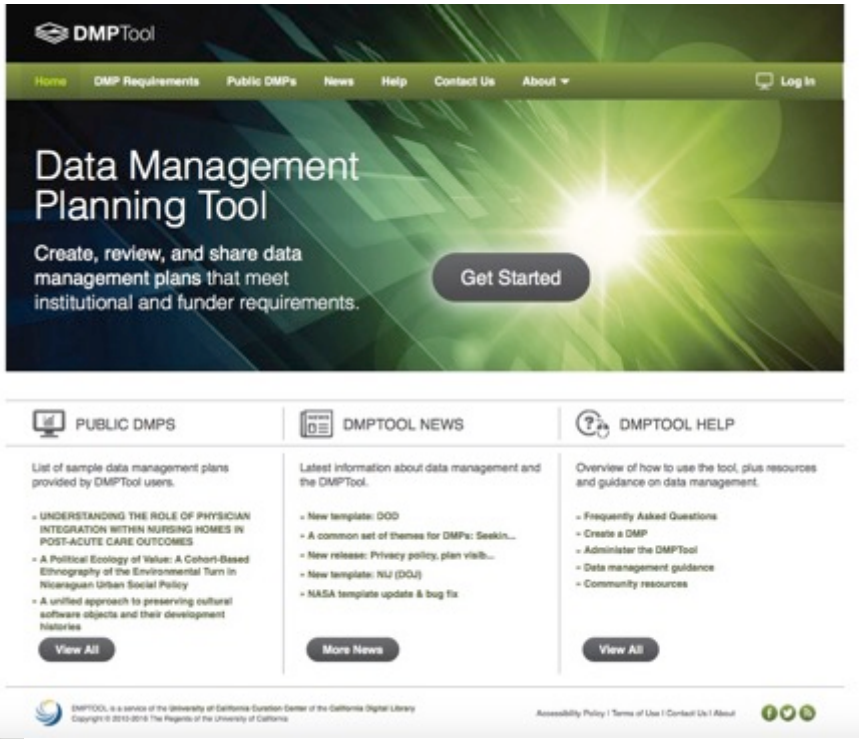
- Good practice for PHD students
- Make available key data for higher education and research
- Share data together with the thesis as underlying data

Final take-home message : The DMP Aide-mémoire

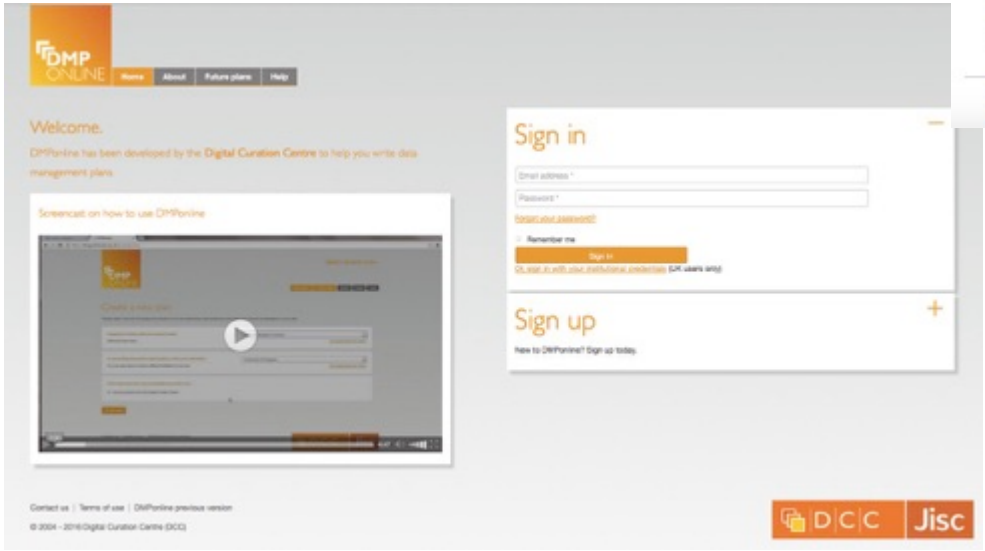
- Is there a model required by the institution/funder?
- Who will contribute to the DMP (team members, partner's projects) ?
- Who can help (documentation professionals, IT, …)?
- Who will use the DMP?
- Use of an online tool?
- Come quickly with a first version
- Updates: required and/or desirable milestones
- Final version
- Identify datasets

Appendix : DMP tools

- Organize work in common
- Deal with the continual updating
- Choose the tool according the project specification? (e.g. confidentiality)



dmptool.org



dmponline.dcc.ac.uk

Appendix : DMPonline (British Digital Curation Centre)

https://dmponline.dcc.ac.uk/

Originally based on the british needs

H2020 template, amongst others, and generic template

Online and offlline

Connexion with DMPTool (US) in progress

Appendix : DMPonline Exercise

1) create an account

2) choose a model

3) Create and share a plan

4) Identify a dataset
   - Definition criteria of a dataset
   - Reasoning of the decision (reproducibility, cost, …)

5) Others datasets? (granularity, strategy and concrete practice, impact)

6) Commenting fonction

7) Export

Let's try…