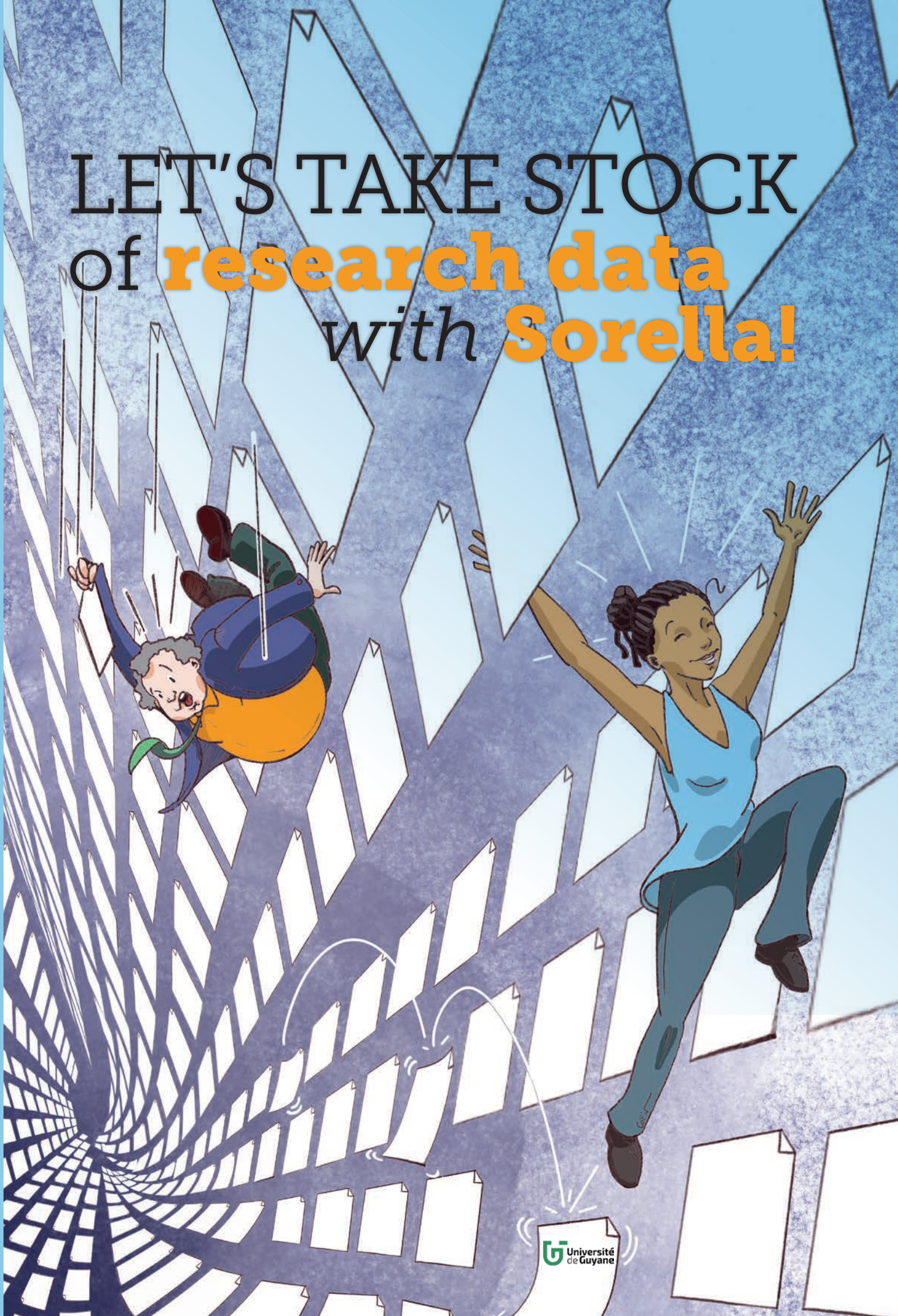
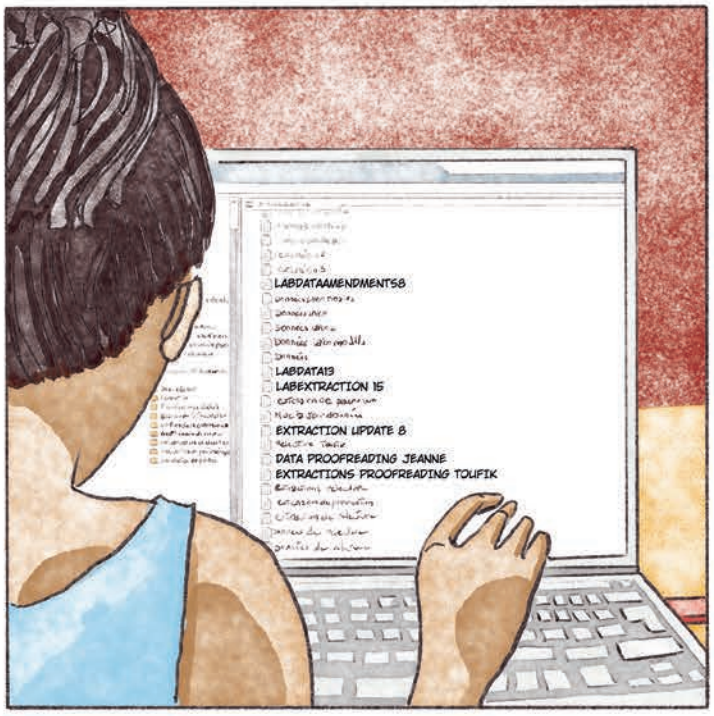
LET'S TAKE STOCK of **research data** *with* **Sorella!**



Université de Guyane


SORELLA!
JEAN-PAUL!


HERE, TAKE THIS. IT'S ALL IN THERE


LABDATAAMENDMENTS8
LABDATA19
LABEXTRACTION 15
EXTRACTION UPDATE 8
DATA PROOFREADING JEANNE
EXTRACTIONS PROOFREADING TOUFIK


JEAN-PAUL!
WHAT IS IT EVEN SUPPOSED TO BE?
WHAT HAVE YOU DONE?


I'VE BEEN TOLD THAT YOU NEED EXCEL SPREADSHEETS TO MANAGE THE DATA!
AND I CAN TELL YOU THAT THESE ARE SOME EXCEL SPREADSHEETS! 60 HOURS OF WORK, WITH THE SUPPORT OF THREE TRAINEES!
BUT DO YOU REALLY THINK A NORMAL PERSON COULD USE THAT?


WELL, THEN! I DO HOPE THEY CAN READ THIS BECAUSE THEY'RE REQUESTING IT! OR IS IT JUST A WHIM OF THEIRS TO ANNOY EVERYBODY?
AS IF WE HAD NOTHING BETTER TO DO THAN PRODUCE USELESS STUFF THAT NOBODY CARES ABOUT!

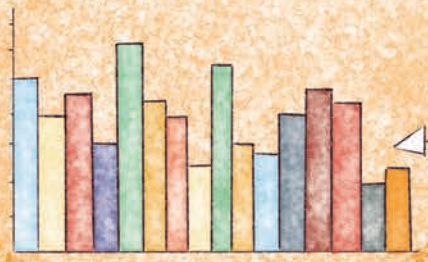

GROMLMLMLLL...
OK, I SEE... IF WE'RE ASKED TO MANAGE OUR PROJECT'S RESEARCH DATA, IT'S NOT A USELESS JOB, YOU KNOW!
LET'S TAKE IT FROM THE TOP TOGETHER, SHALL WE?...

THERE ARE ACTUALLY MANY DIFFERENT TYPES OF DATA, AND THEY VARY DEPENDING ON THE TOPICS ADDRESSED AND THE DISCIPLINES COVERED. ACCORDING TO CONTEXT, THEY CAN BE:

Experimental data
(biomass weight, peptide sequences, psychology tests, etc.)

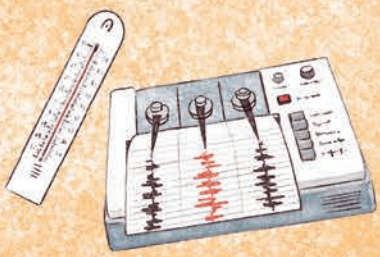
Digital simulation data
(climate models, economic models, etc.)

Derived or compiled data
(compiled databases, text mining, population statistics, etc.)



Reference data (text corpuses, TP53 gene sequences, chemical structures, etc.)

Observation data
(weather records, seismic readings, images, social surveys, archaeological excavations, etc.)



Archival data (glass plates, photograph stocks, legal texts, plants seeds, etc.)

In fact, according to the OECD's 2007 definition, research data refers to all "factual records (numerical scores, textual records, images and sounds) used as primary sources for scientific research, and that are commonly accepted in the scientific community as necessary to validate research findings".

But for this data to serve as evidence for the scientific community, it must be appropriately processed, organised and shared!

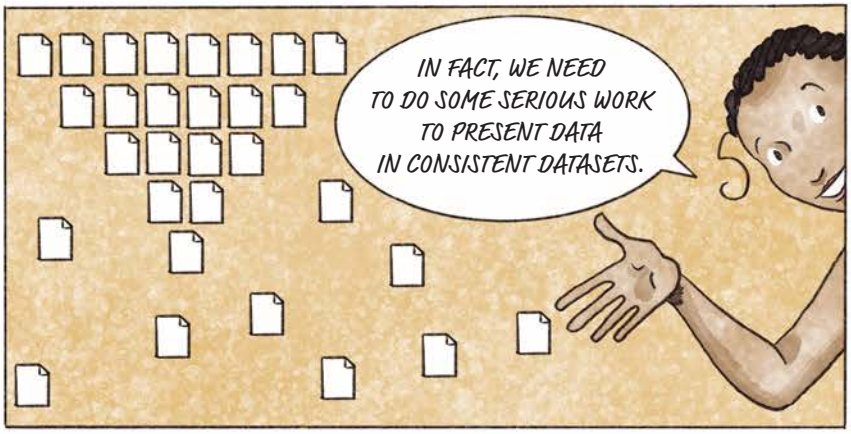
There are three stages in the data lifecycle.

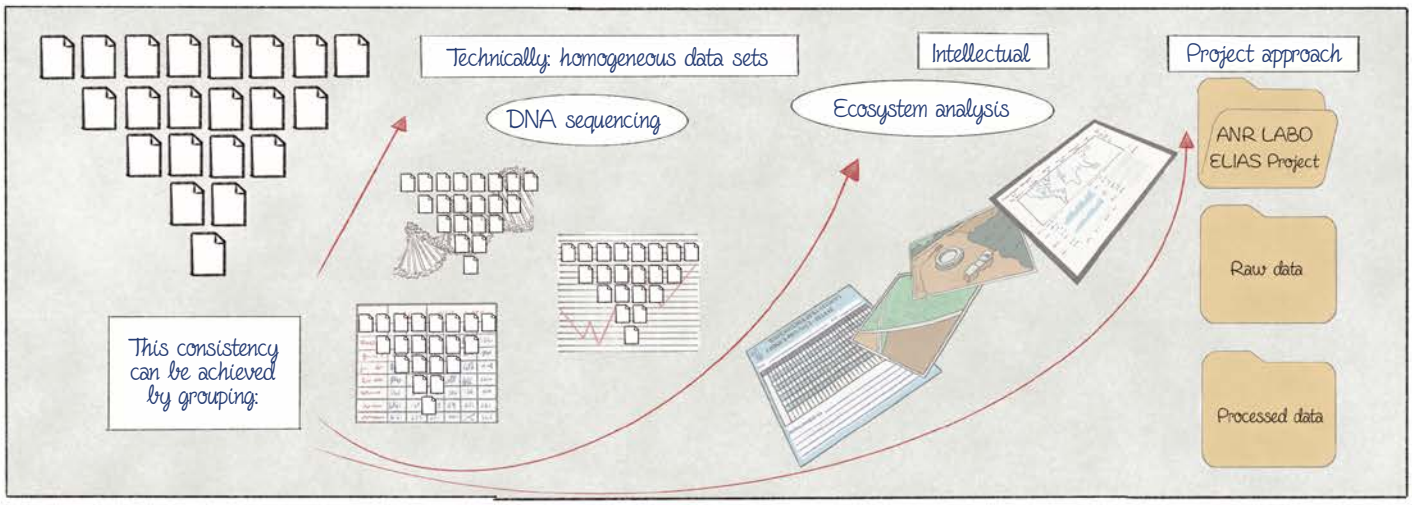
Stage 1:
raw data. It has been collected, but not yet organised, edited or analysed.

Stage 2:
Processed data. For instance, it may have undergone calibration, benchmarking or adjustment of the raw data. It has also been derived, and presents a summary or a specific representation/view (aggregation, compilation, calculation, reorganisation, etc.).

Stage 3:
Data has been processed and analysed. This generally marks the final stage before the research results are published in scientific articles.

Each of these stages can also serve as source material for researchers, depending on their needs.





The Open Science movement – i.e. the free access to scientific data and outputs – is closely linked to that of public data – data resulting from public research being considered as public data by its very nature. This has been enshrined in the Research Code since the 2016 Digital Republic Act.

Public sector data

1978
Cada Act
Access to Administrative Documents

2003
PSI Directive
Re-use of public sector information

2007
Inspire Directive
Accessibility to geographic environmental data

2013
Revised PSI Directive
G8 Charter
For the accessibility to public sector data

2003
Berlin Declaration
Free access to knowledge

2007
OECD Declaration
Open access to publicly funded research data

2012
Mandatory open access to publications from European projects. Horizon 2020 programme. A pilot project for research data.

2016
Digital Republic Act

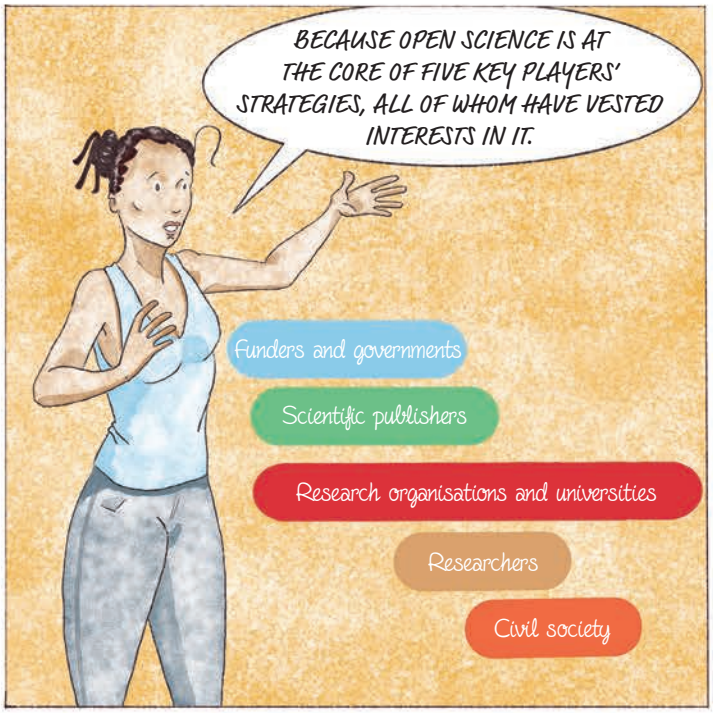
2018
1st National Plan for Open Science
Open access to publications and towards open access to data (FR)

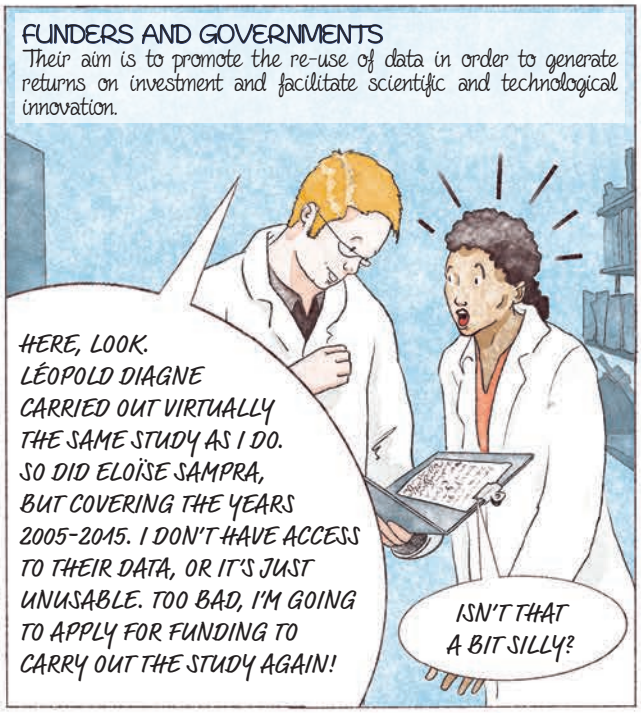
2019
ANR: mandatory data management plan for funded projects

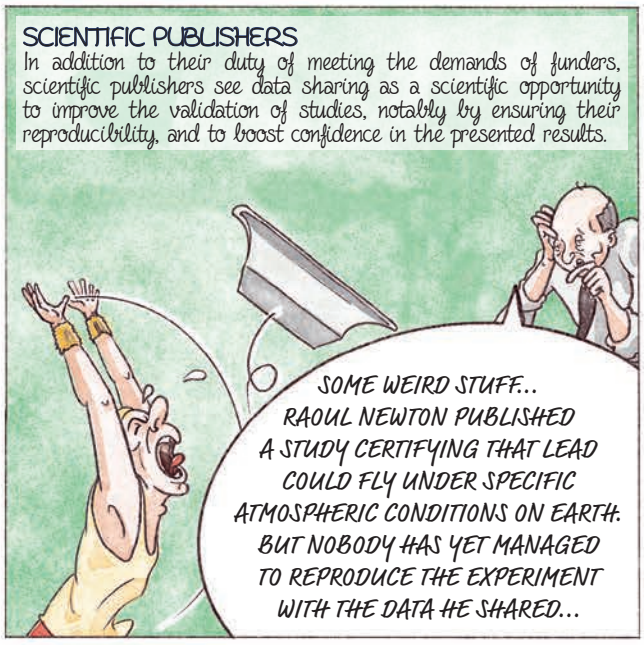
2021
2nd National Plan for Open Science
Broadening (source code, practices, funding)

Open Science

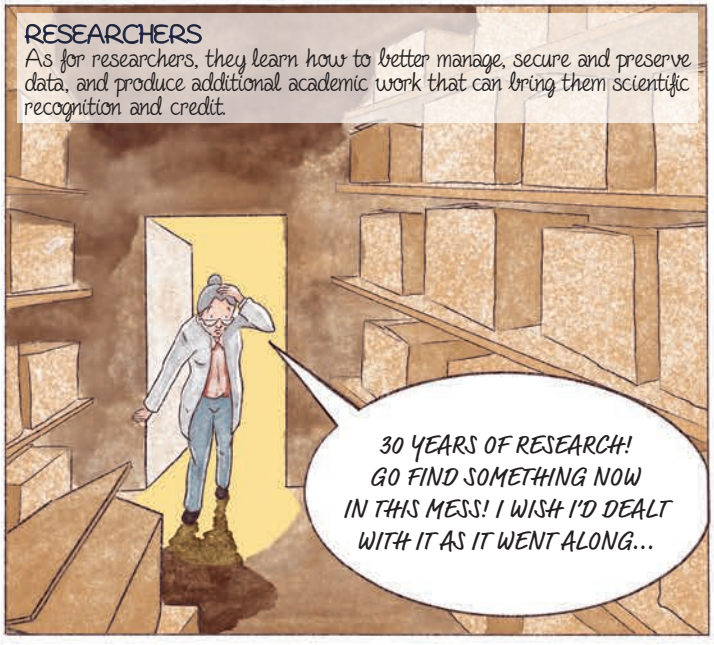
As part of a European dynamic, the 2nd axis of the 2nd National Open Science Plan for 2021-2024 recommends that French researchers "structure, share and open up research data". Many funding organisations make this a requirement for the allocation of funds, or at the very least to submit a data management plan (DMP).

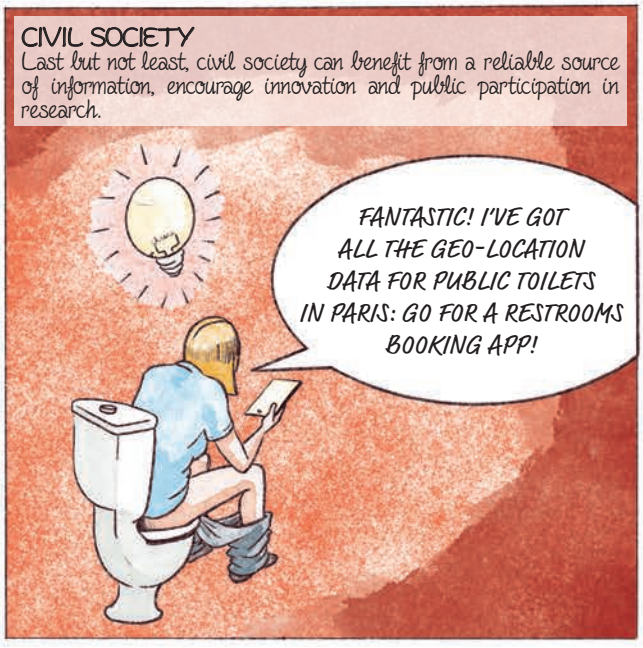

BECAUSE OPEN SCIENCE IS AT THE CORE OF FIVE KEY PLAYERS' STRATEGIES, ALL OF WHOM HAVE VESTED INTERESTS IN IT.
Funders and governments
Scientific publishers
Research organisations and universities
Researchers
Civil society

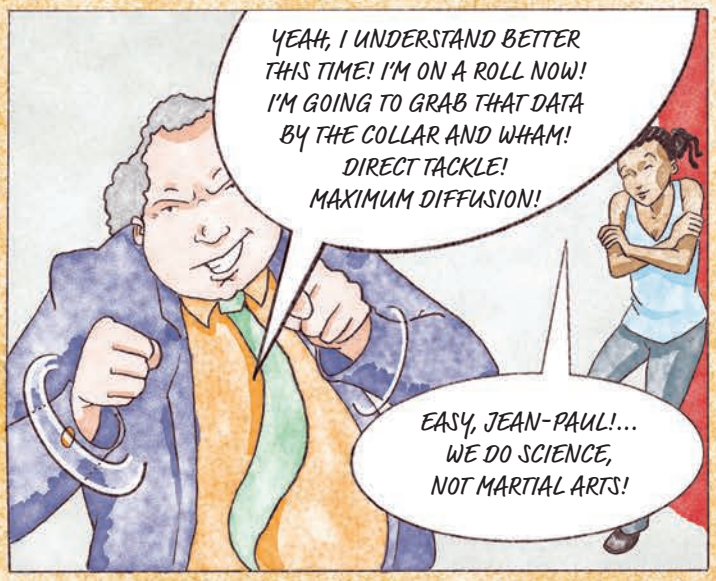

FUNDERS AND GOVERNMENTS
Their aim is to promote the re-use of data in order to generate returns on investment and facilitate scientific and technological innovation.
HERE, LOOK. LÉOPOLD DIAGNE CARRIED OUT VIRTUALLY THE SAME STUDY AS I DO. SO DID ELOÏSE SAMPRA, BUT COVERING THE YEARS 2005-2015. I DON'T HAVE ACCESS TO THEIR DATA, OR IT'S JUST UNUSABLE. TOO BAD, I'M GOING TO APPLY FOR FUNDING TO CARRY OUT THE STUDY AGAIN!
ISN'T THAT A BIT SILLY?

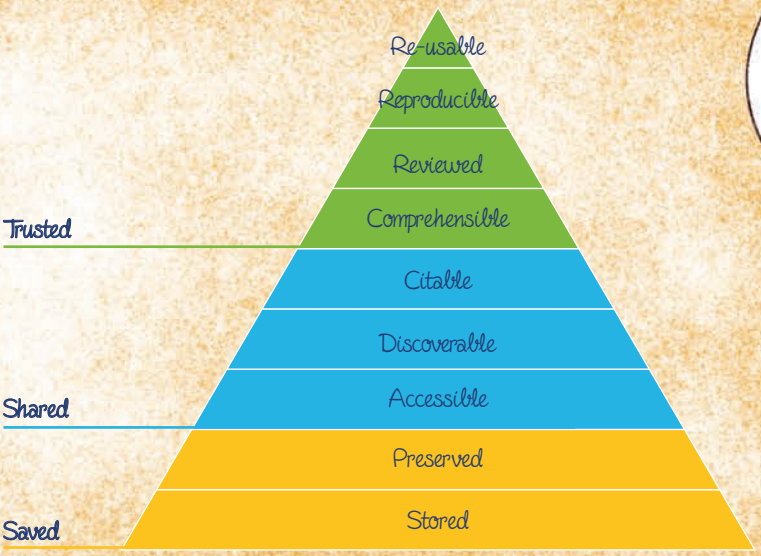

SCIENTIFIC PUBLISHERS
In addition to their duty of meeting the demands of funders, scientific publishers see data sharing as a scientific opportunity to improve the validation of studies, notably by ensuring their reproducibility, and to boost confidence in the presented results.
SOME WEIRD STUFF... RAOUL NEWTON PUBLISHED A STUDY CERTIFYING THAT LEAD COULD FLY UNDER SPECIFIC ATMOSPHERIC CONDITIONS ON EARTH. BUT NOBODY HAS YET MANAGED TO REPRODUCE THE EXPERIMENT WITH THE DATA HE SHARED...


RESEARCH ORGANISATIONS AND UNIVERSITIES
This is an opportunity for them to promote good ethics and the reproducibility of research within laboratories, by improving resources management and encouraging collaboration between institutions.
HERE IS JEANNINE DUGLAS, A SPECIALIST IN DROSOPHILA REPRODUCTION IN NEW GUINEA, PRESENTING HER NEW PROJECT.
WELL, WE'RE WORKING ON DROSOPHILA DNA. DO YOU THINK WE COULD HAVE HER SEND US THE DATA?


RESEARCHERS
As for researchers, they learn how to better manage, secure and preserve data, and produce additional academic work that can bring them scientific recognition and credit.
30 YEARS OF RESEARCH! GO FIND SOMETHING NOW IN THIS MESS! I WISH I'D DEALT WITH IT AS IT WENT ALONG...


CIVIL SOCIETY
Last but not least, civil society can benefit from a reliable source of information, encourage innovation and public participation in research.
FANTASTIC! I'VE GOT ALL THE GEO-LOCATION DATA FOR PUBLIC TOILETS IN PARIS: GO FOR A RESTROOMS BOOKING APP!

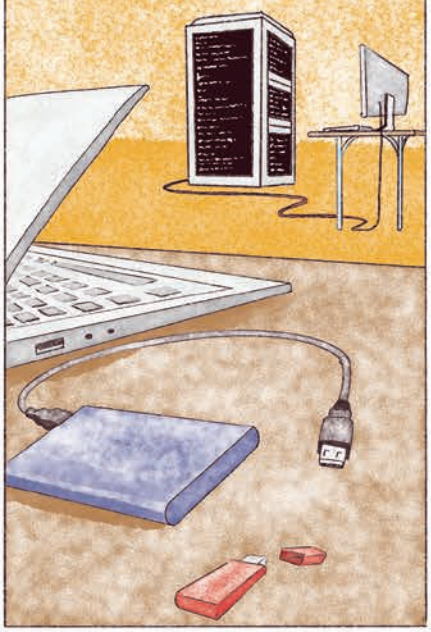




From A. de Waard. The Mendeley Data management platform: Research data management from a publisher's perspective. (2017) in Danielle Descoteaux, Chiara Farinelli, Marina Soares e Silva, Anita de Waard; Playing Well on the Data FAIRground: Initiatives and Infrastructure in Research Data Management. Data Intelligence 2019; 1 (4): 350–367. doi: https://doi.org/10.1162/dint_a_00020

Step 1: Saved data

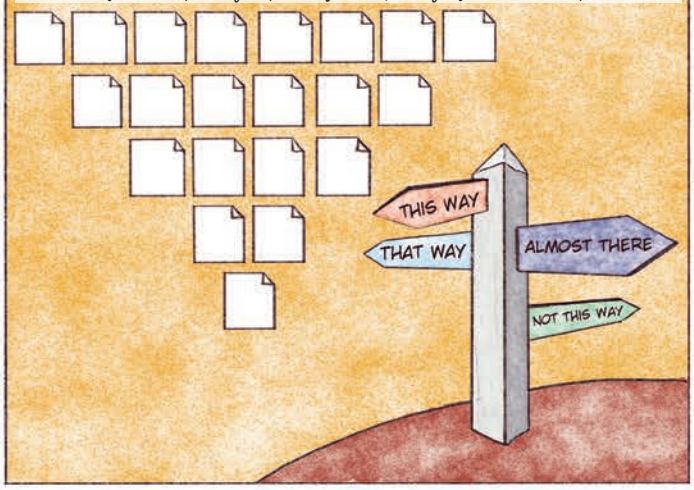
Data must first be **stored**, ideally according to the 3-2-1 rule: 3 identical copies, stored on 2 different media + 1 off-site copy.



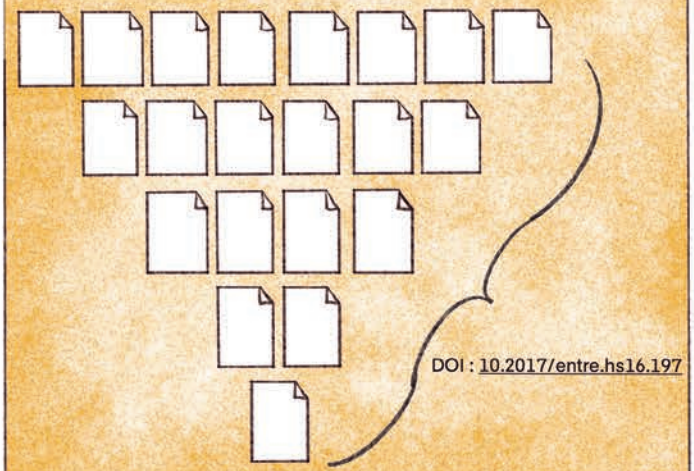
This is however not sufficient. To prevent IT technologies obsolescence, data must be **preserved**, i.e. selected on the basis of various criteria and varying lifespans (storage for 6 months, 3 years, 10 years, etc.).

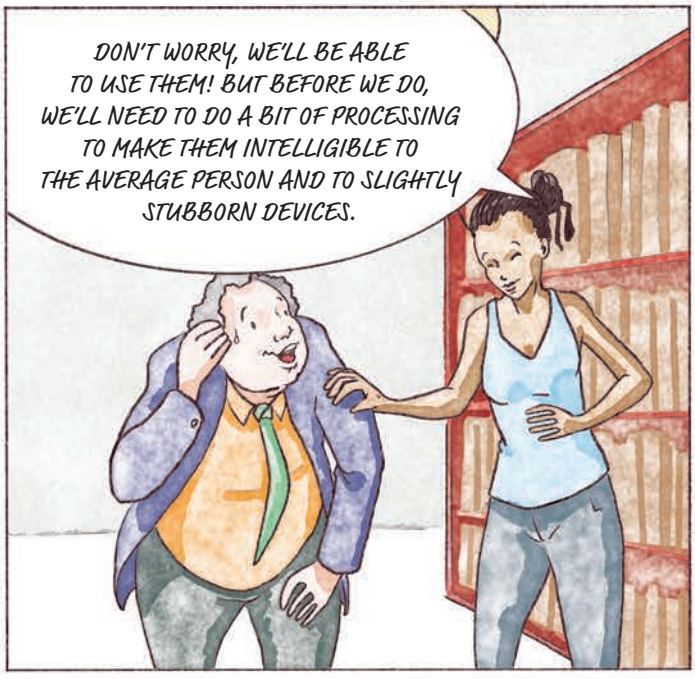
Even when data is stored and preserved, it is not necessarily available to researchers and other devices seeking to interrogate it. At the very least, it should be made **accessible** online.

However, even online, research data is not always easy to find by other **researchers**. It is therefore important to make them more widely known - for example by improving the quality of their description.



Furthermore, in order to monitor the re-use of this data and ensure that researchers who produced it receive the scientific credit they deserve, it is advisable to make it **citeable**, for example by assigning it a DOI (Digital Object Identifier) or linking it to a data-paper.



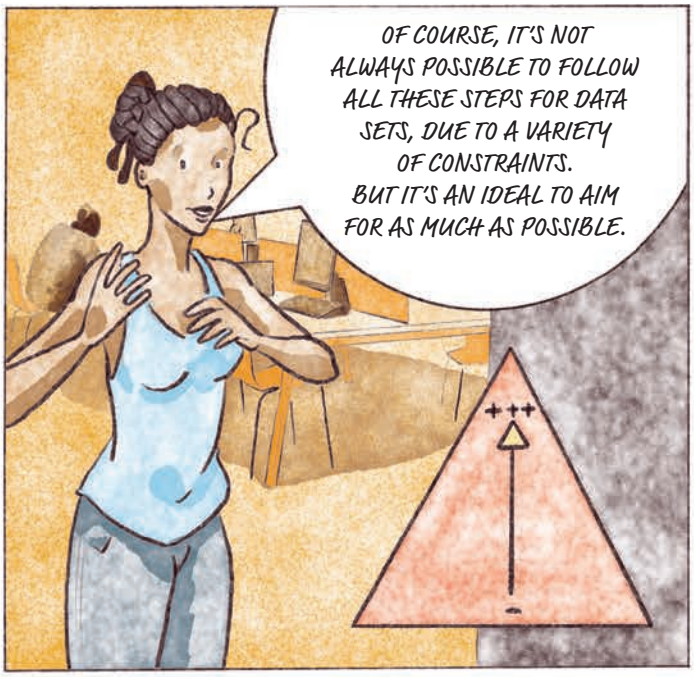


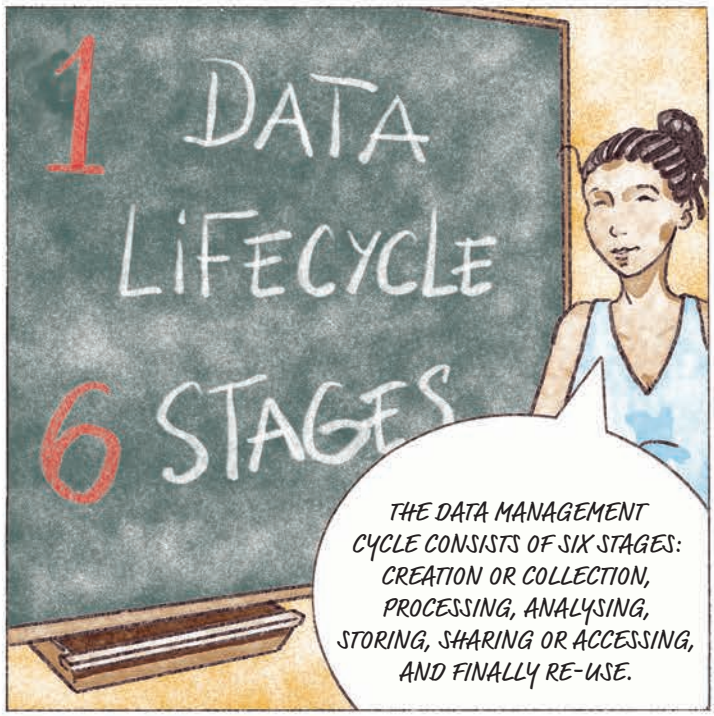
Data that has been collected for internal use is not necessarily **comprehensible** to a third party. It is therefore important to document the data collection: what units of measure were used? What is the context? What abbreviations and parameters were employed? It is also necessary to describe them as accurately as possible - particularly by means of exhaustive and precise metadata.

In order to scientifically **validate** this data, it can also be useful to have it reviewed by peers. Reviewing systems also exist for research data (such as data-papers).

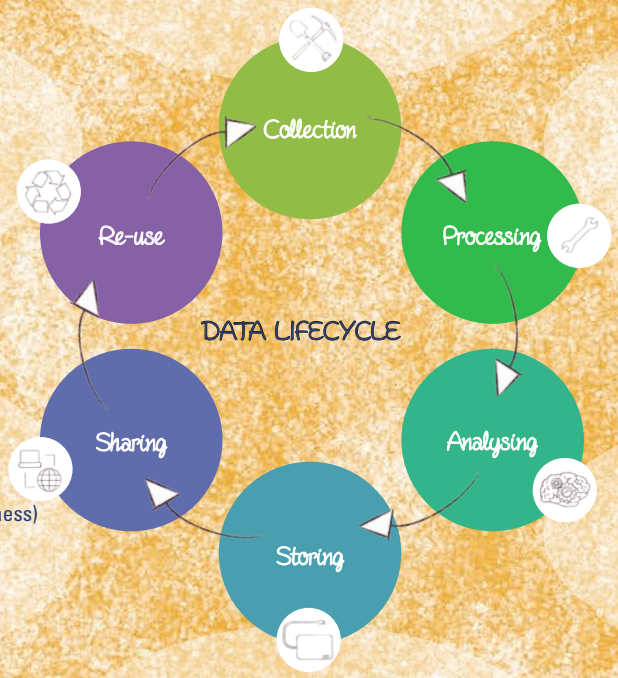
Reproducibility of research increases the credibility of results.

Research data that is comprehensible, reliable and reproducible is more likely to be re-used and cited by other researchers. A user licence should therefore be applied to the data, providing a strict framework for **re-use** by other researchers.





- Drafting of a Data Management Plan (DMP)
- Locating existing data
- Obtaining authorisations/consents where necessary (Compliance with the General Data Protection Regulation (GDPR) for personal, sensitive data)
- Collection/Acquisition of data
- Creation of descriptive metadata



- Checking, data cleansing and validation
- Data description
- Data management and storage

- Data interpretation
- Production of scientific results
- Possible patent protection
- Publication of scientific articles

- Migration of data to the best format and most appropriate medium
- Increased metadata and documentation
- Data back-up and storage
- Deposit data in a repository
- Selection and long-term archiving of data

- Definition of data access rights, including: level of openness (from internal openness to public openness)
- Conditions for the use of data: selection of a re-use licence

- New research
- Re-examination of results/data
- Teaching and learning
- Compliance with re-use licence

From Institut Pasteur:
www.pasteur.fr/fr/ceris/bibliotheque/gerer-ses-donnees-recherche

LEGAL ISSUES: OPEN OR NON-OPEN DATA?

Data that can be distributed

Free communication if (cf. Digital Republic Act, Oct. 2016):
- data resulting from a research activity at least semi-financed by public funds
- not protected by a specific law
- made public by the researcher or the institution (the institution decides which data will be open, where and under what conditions it will be deposited).
- Compulsory disclosure of some geographical and environmental data (cf. Inspire convention and Arrhus convention)

Data that can be distributed under specific conditions

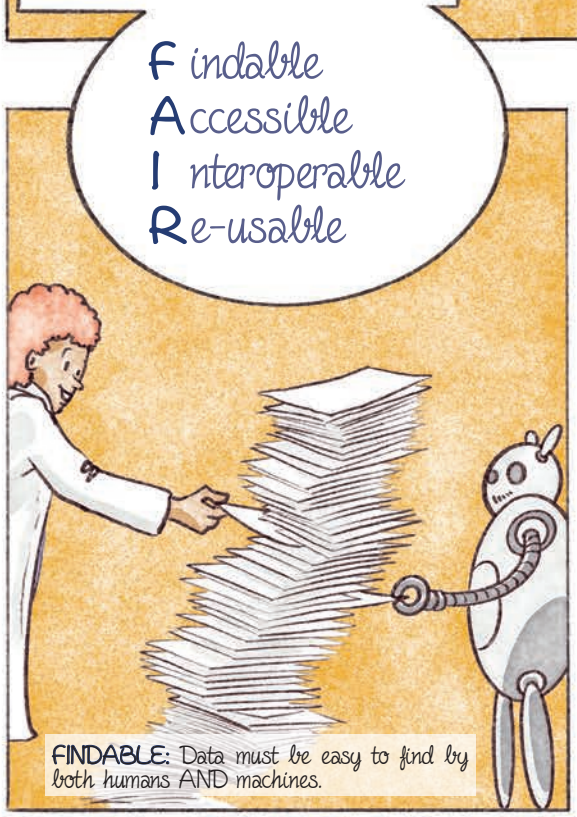
- Data presenting risks for the protection of the nation's scientific and technical potential (cf. "protected unit" laboratory)
- Restricted areas: physical and digital access subject to authorisation
- Data protected by copyright and other intellectual property laws
- Personal data (see General Data Protection Regulation (GDPR))

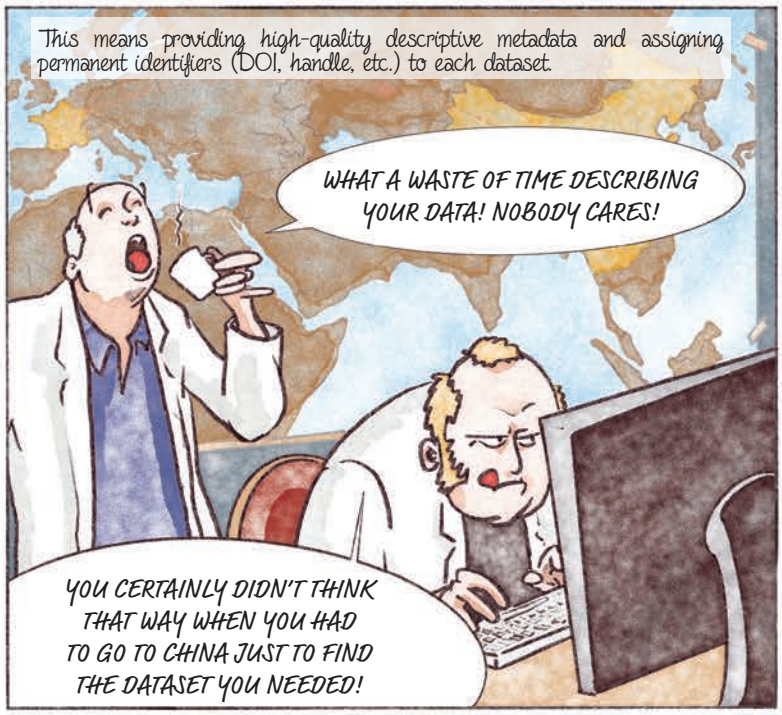
Data prohibited for distribution

- Data presenting risks for the protection of national defense secrets
- Data presenting risks for the security of the State, public safety or the security of the institution
- Professional secrecy or confidentiality (medical secrecy, investigation secrecy, banking and tax secrecy)

In order to achieve this goal, data sharing must comply with a set of best practices that enable it to be discovered and used by humans – but also by machines. This necessary commitment is summed up by the acronym "FAIR".

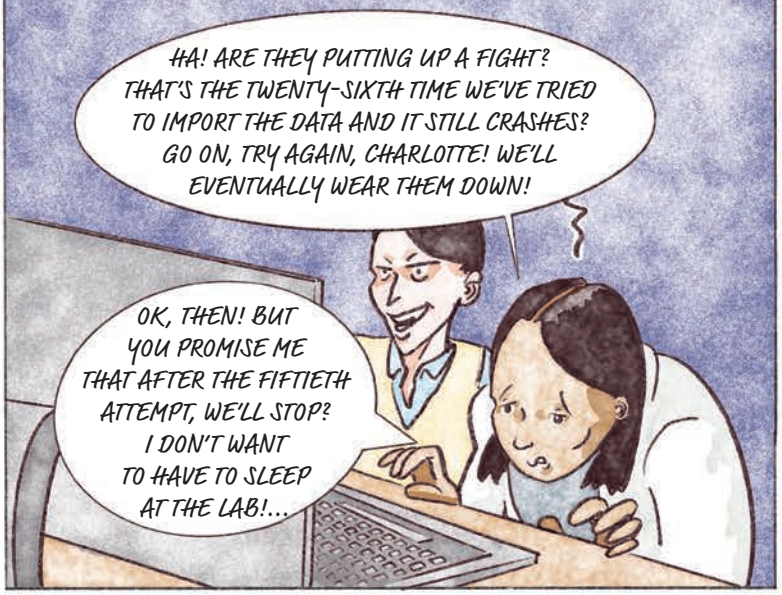
From Dominique L'Hostis, From management plan to data-paper, June 2019
https://gricad-media.univ-grenoble-alpes.fr/video/plan-gestion-donnees-au-data-paper



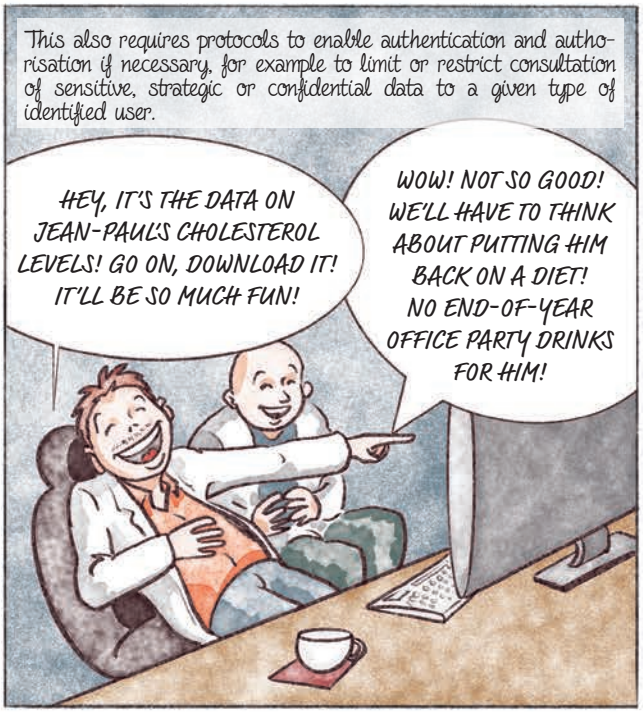


ACCESSIBLE: Data and metadata must be stored for the long term, with easy access and/or downloading, specifying the conditions of access and use.

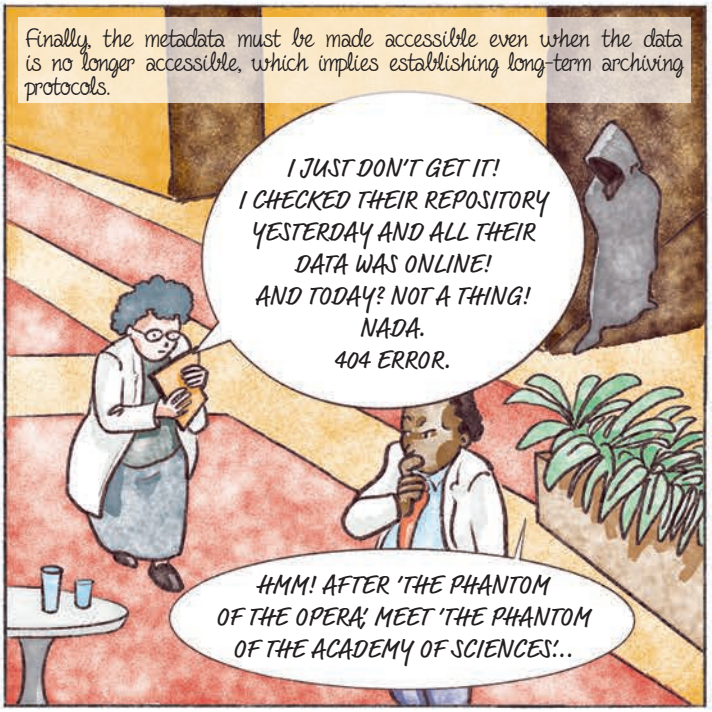
This requires data to be made accessible by its identifiers via a standardised communication protocol (e.g. HTTPS, REST API). It is recommended to mainly use open, free protocols that can be universally implemented.



This also requires protocols to enable authentication and authorisation if necessary, for example to limit or restrict consultation of sensitive, strategic or confidential data to a given type of identified user.

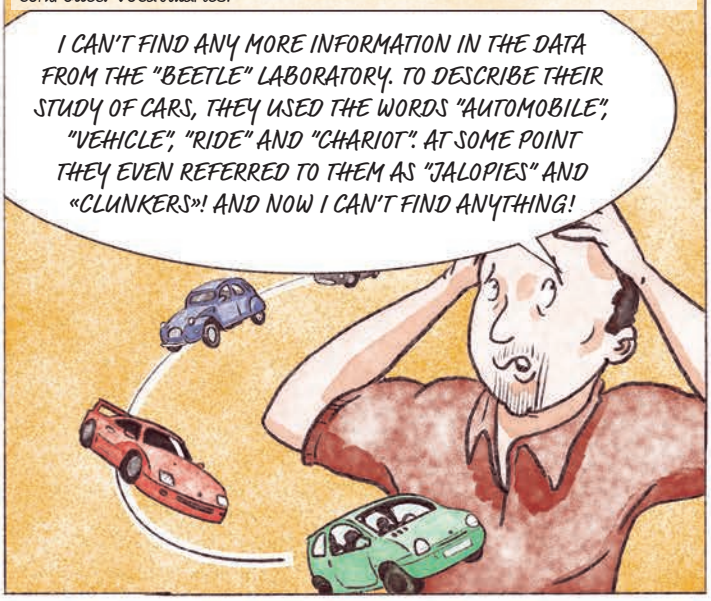


Finally, the metadata must be made accessible even when the data is no longer accessible, which implies establishing long-term archiving protocols.

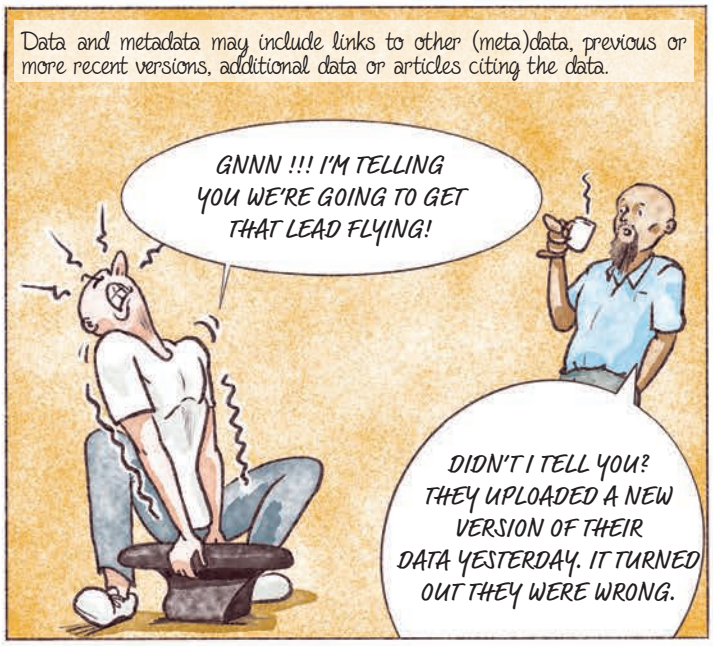


INTEROPERABLE: Data and metadata must be downloadable, usable, intelligible and combinable with other data, by humans AND by machines.

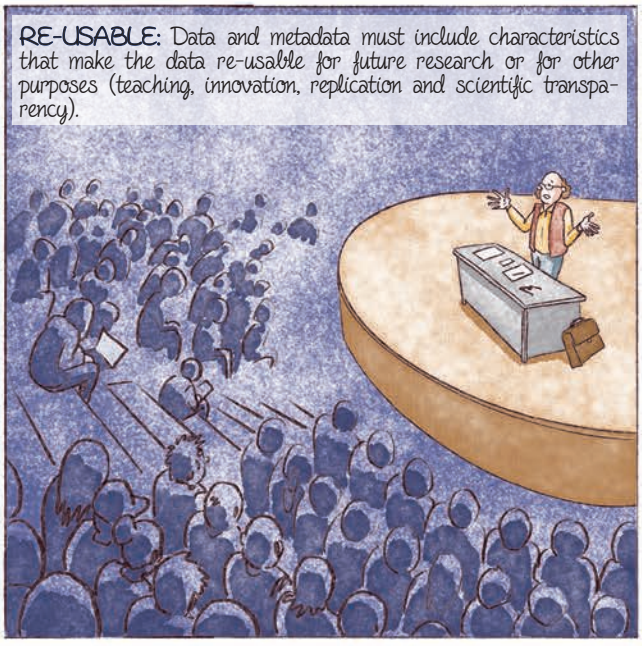
Data and metadata should use a formal, accessible and shared language that is widely applicable to knowledge representation, such as Semantic Web technologies. It is recommended to use standard ontologies and controlled vocabularies.



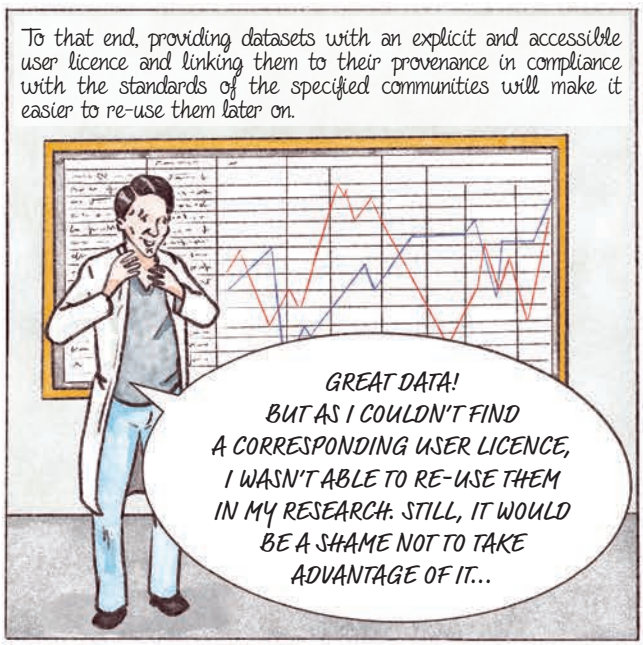
Data and metadata may include links to other (meta)data, previous or more recent versions, additional data or articles citing the data.

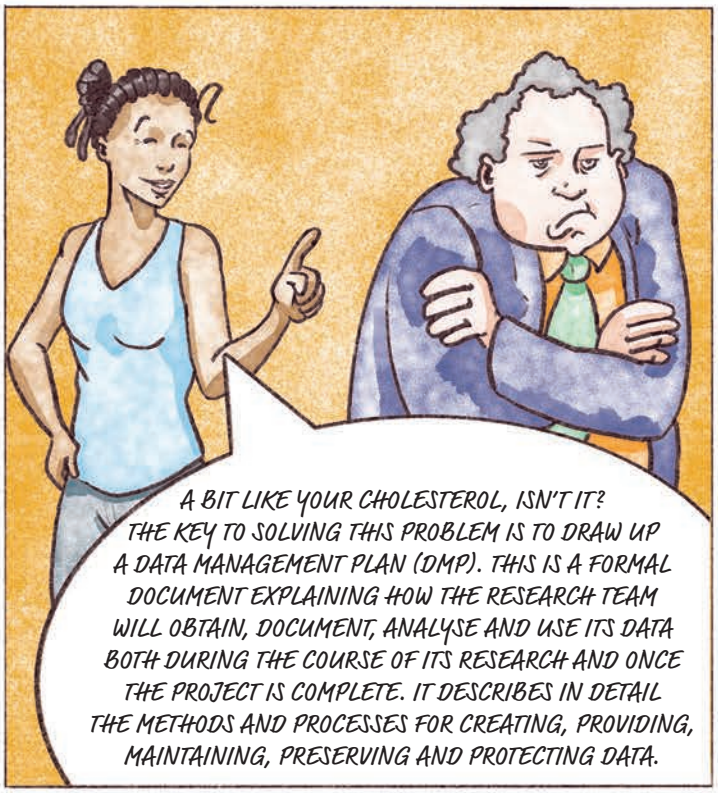


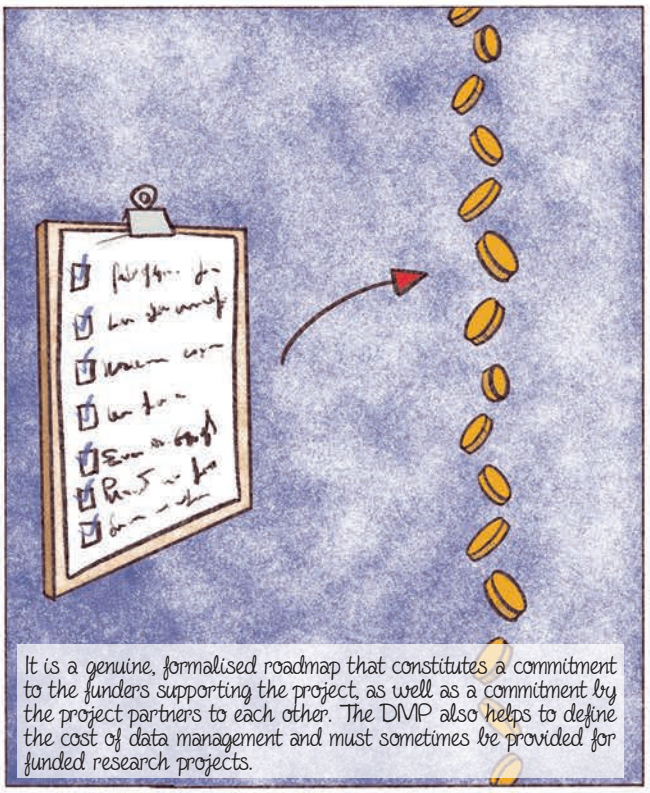
RE-USABLE: Data and metadata must include characteristics that make the data re-usable for future research or for other purposes (teaching, innovation, replication and scientific transparency).



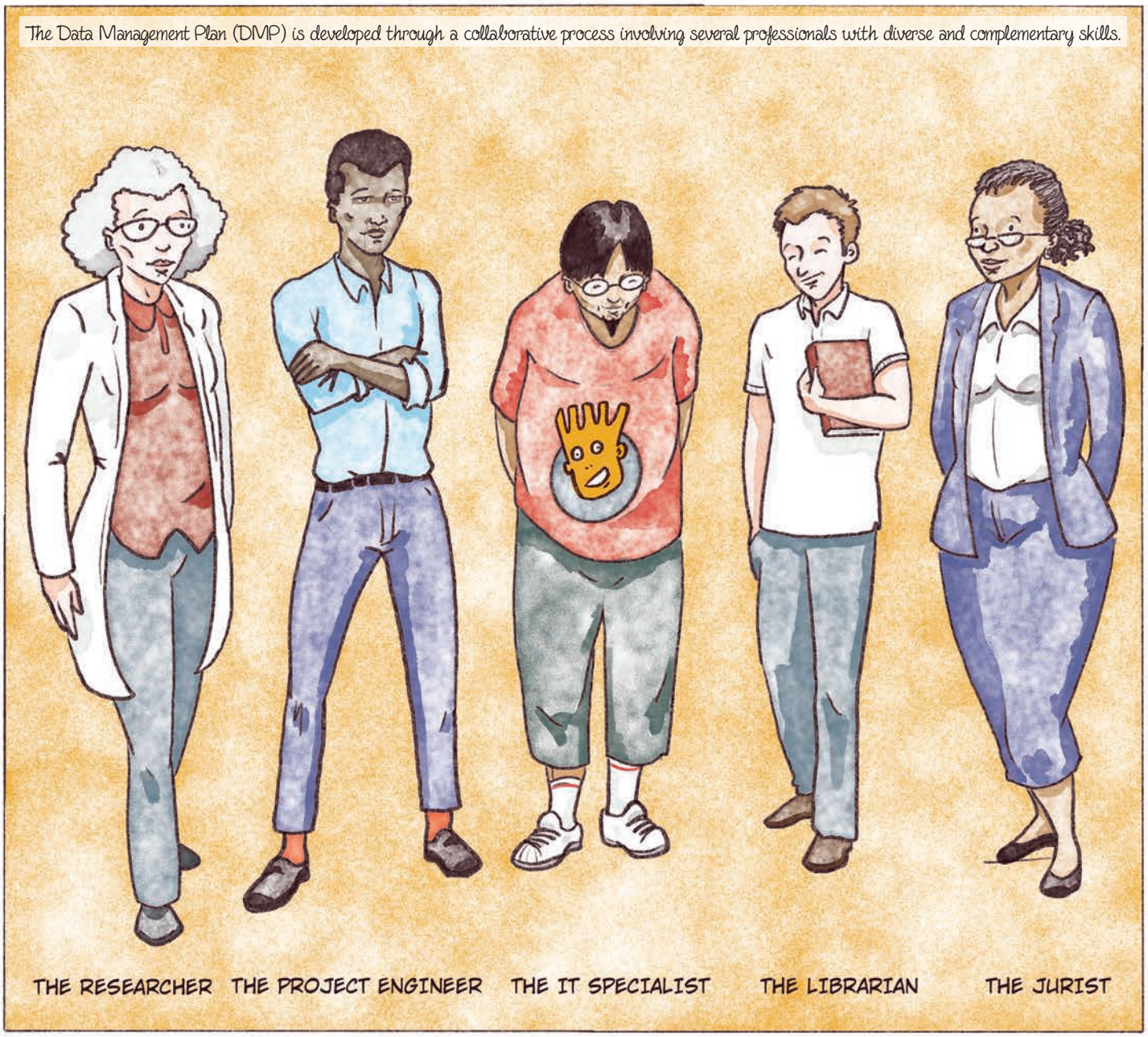
To that end, providing datasets with an explicit and accessible user licence and linking them to their provenance in compliance with the standards of the specified communities will make it easier to re-use them later on.







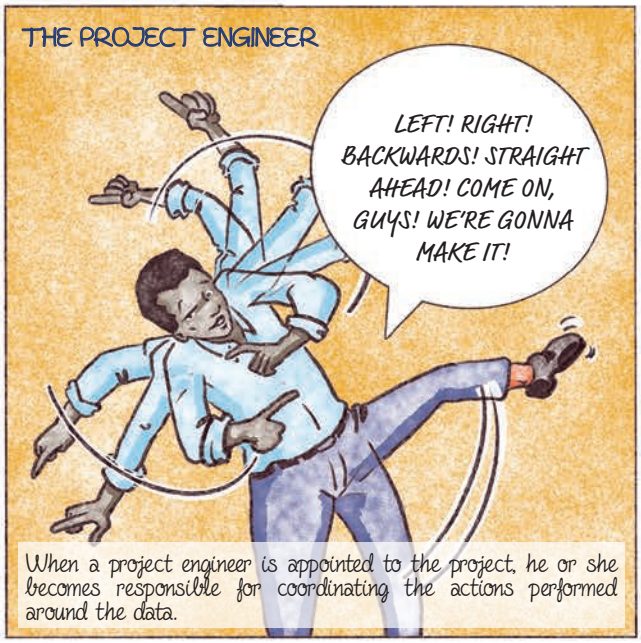
The Data Management Plan (DMP) is developed through a collaborative process involving several professionals with diverse and complementary skills.



THE RESEARCHER

The researcher is in charge of collecting, describing and breaking down the data into consistent sets.

THE PROJECT ENGINEER

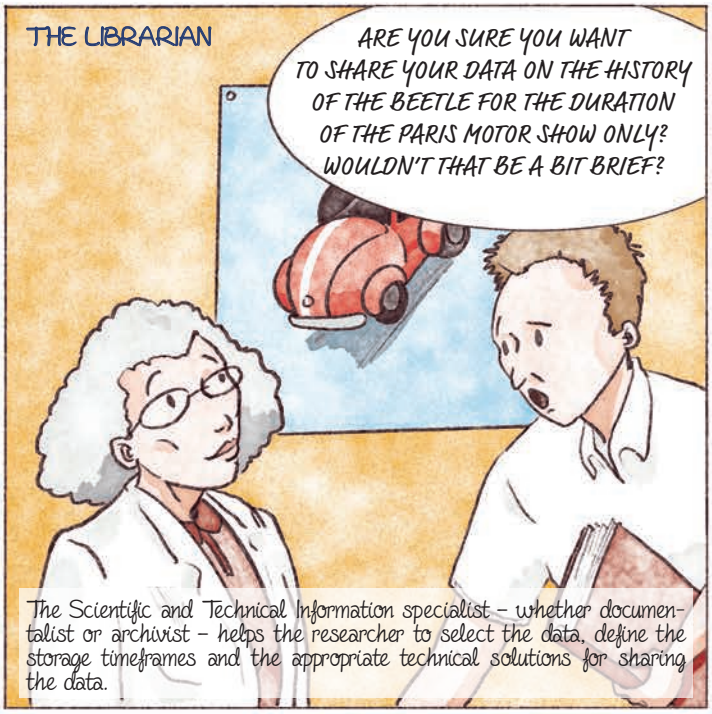


When a project engineer is appointed to the project, he or she becomes responsible for coordinating the actions performed around the data.

THE IT SPECIALIST

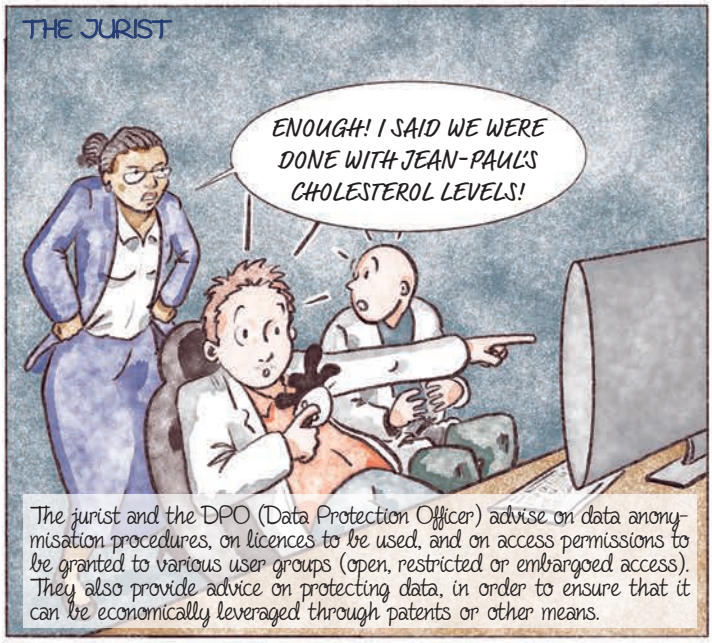
The IT specialist is the key contact when it comes to data storage and security, infrastructure and cost aspects.

THE LIBRARIAN



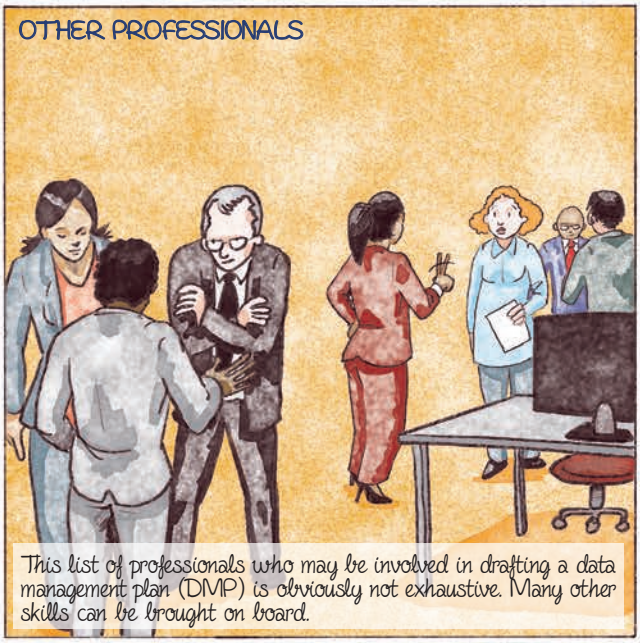
The Scientific and Technical Information specialist – whether documentalist or archivist – helps the researcher to select the data, define the storage timeframes and the appropriate technical solutions for sharing the data.

THE JURIST



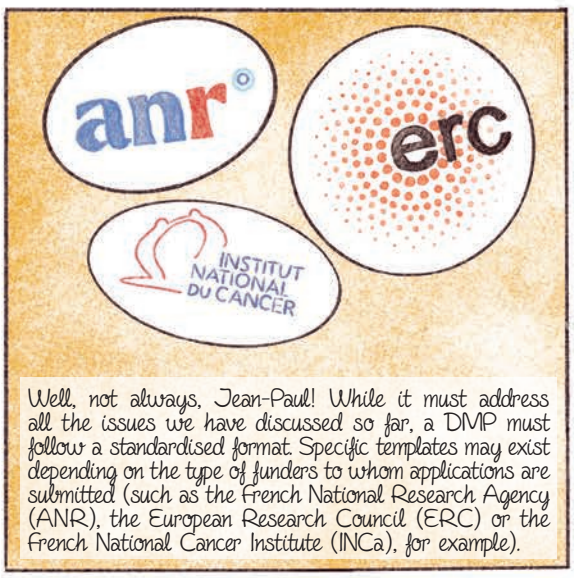
The jurist and the DPO (Data Protection Officer) advise on data anonymisation procedures, on licences to be used, and on access permissions to be granted to various user groups (open, restricted or embargoed access). They also provide advice on protecting data, in order to ensure that it can be economically leveraged through patents or other means.

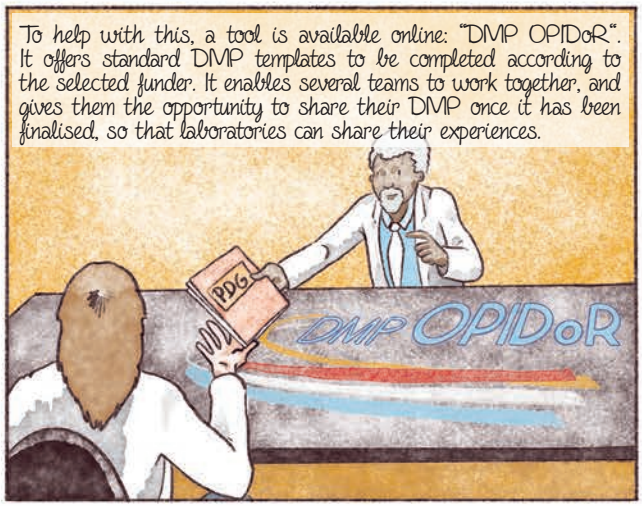
OTHER PROFESSIONALS

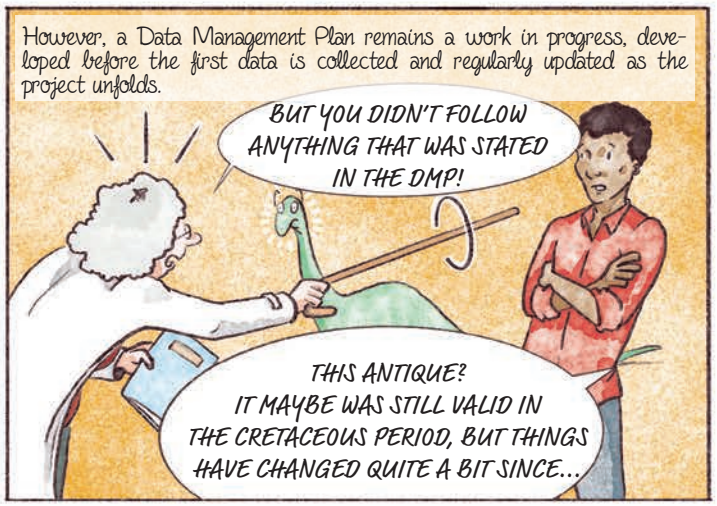


This list of professionals who may be involved in drafting a data management plan (DMP) is obviously not exhaustive. Many other skills can be brought on board.


WELL, IF THAT'S FOR A GREATER GOOD, THEN I'M WILLING TO TAKE ON THE TASK OF WRITING THIS DATA MANAGEMENT PLAN. HOW SHOULD IT BE PRESENTED? CAN WE SUBMIT IT AS AN EXCEL SPREADSHEET?


anr
erc
INSTITUT NATIONAL DU CANCER
Well, not always, Jean-Paul! While it must address all the issues we have discussed so far, a DMP must follow a standardised format. Specific templates may exist depending on the type of funders to whom applications are submitted (such as the French National Research Agency (ANR), the European Research Council (ERC) or the French National Cancer Institute (INCa), for example).


To help with this, a tool is available online: "DMP OPIDoR". It offers standard DMP templates to be completed according to the selected funder. It enables several teams to work together, and gives them the opportunity to share their DMP once it has been finalised, so that laboratories can share their experiences.
PDG
DMP OPIDoR


However, a Data Management Plan remains a work in progress, developed before the first data is collected and regularly updated as the project unfolds.
BUT YOU DIDN'T FOLLOW ANYTHING THAT WAS STATED IN THE DMP!
THIS ANTIQUE? IT MAYBE WAS STILL VALID IN THE CRETACEOUS PERIOD, BUT THINGS HAVE CHANGED QUITE A BIT SINCE...

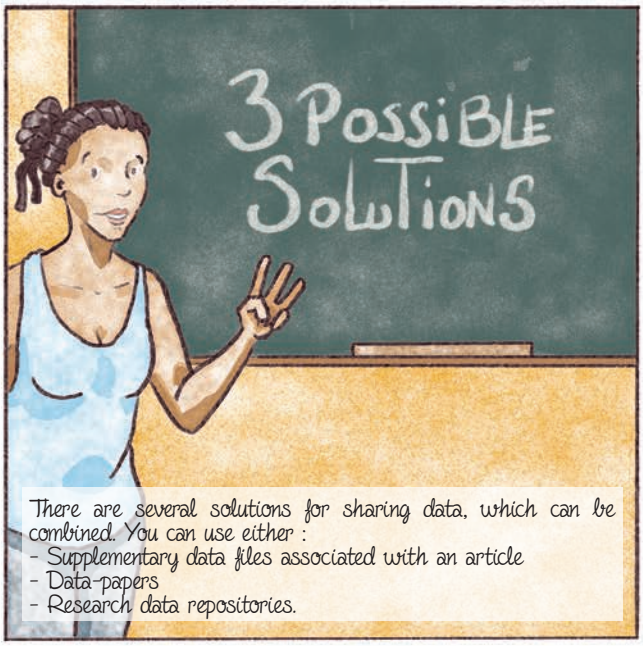

LET'S GET GOING! BIG TIME! SINCE PUTTING A SIMPLE EXCEL SPREADSHEET ONLINE SEEMS TO BE PROHIBITED, AS OF TOMORROW I'M GOING TO ASK OUR IT DEPARTMENT TO CREATE A SUITABLE DATABASE TO HOST OUR DATA.


SLOW DOWN, JEAN-PAUL! THERE ALREADY ARE PLENTY OF DATA REPOSITORIES. IT'S PREFERABLE TO USE THEM RATHER THAN CREATE YET ANOTHER "IN-HOUSE TOOL"! AND THEN THERE ARE COMPLEMENTARY SOLUTIONS FOR VALORISATION, SUCH AS DATA-PAPERS OR APPENDICES ATTACHED TO PUBLISHED ARTICLES!


REALLY? WHAT ARE THEY? I'M INTERESTED!

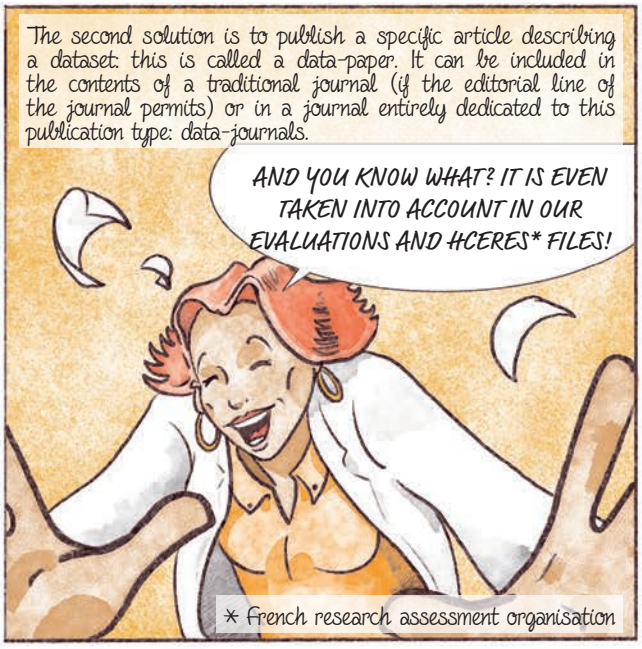

SO LET'S GET DOWNTO A QUICK OVERVIEW OF THE VARIOUS AVAILABLE DATA-SHARING TOOLS!

3. Sharing research data: which tools to use?



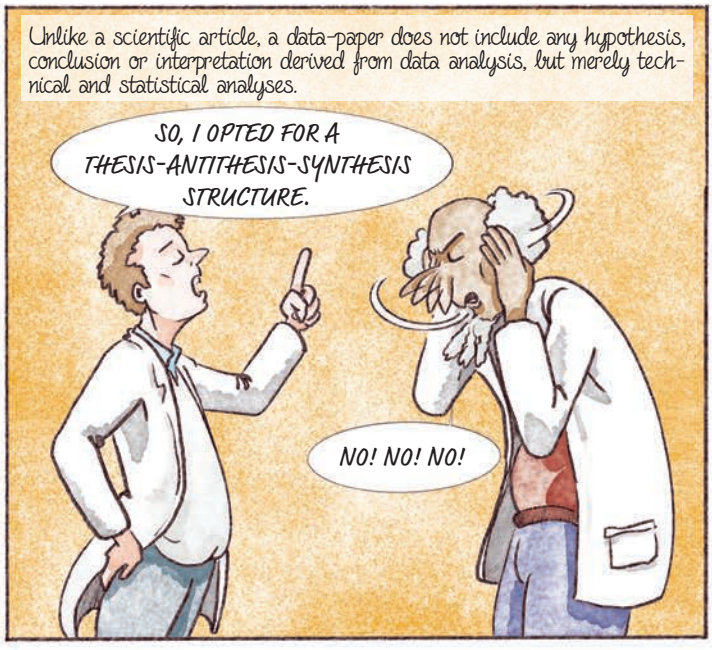
There are several solutions for sharing data, which can be combined. You can use either :
- Supplementary data files associated with an article
- Data-papers
- Research data repositories.

The second solution is to publish a specific article describing a dataset: this is called a data-paper. It can be included in the contents of a traditional journal (if the editorial line of the journal permits) or in a journal entirely dedicated to this publication type: data-journals.

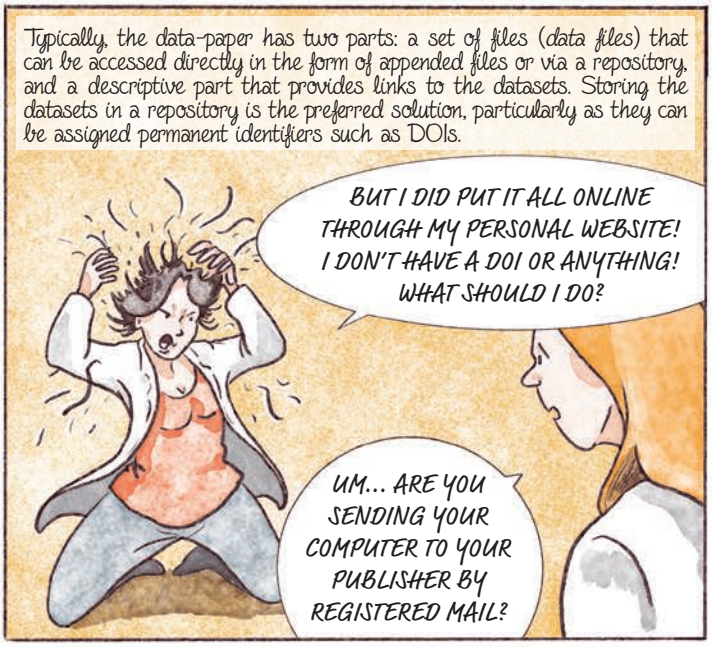


* French research assessment organisation

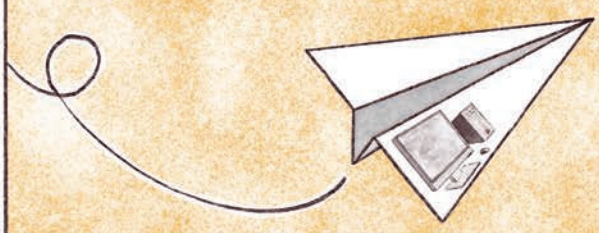
Unlike a scientific article, a data-paper does not include any hypothesis, conclusion or interpretation derived from data analysis, but merely technical and statistical analyses.



Typically, the data-paper has two parts: a set of files (*data files*) that can be accessed directly in the form of appended files or via a repository, and a descriptive part that provides links to the datasets. Storing the datasets in a repository is the preferred solution, particularly as they can be assigned permanent identifiers such as DOIs.

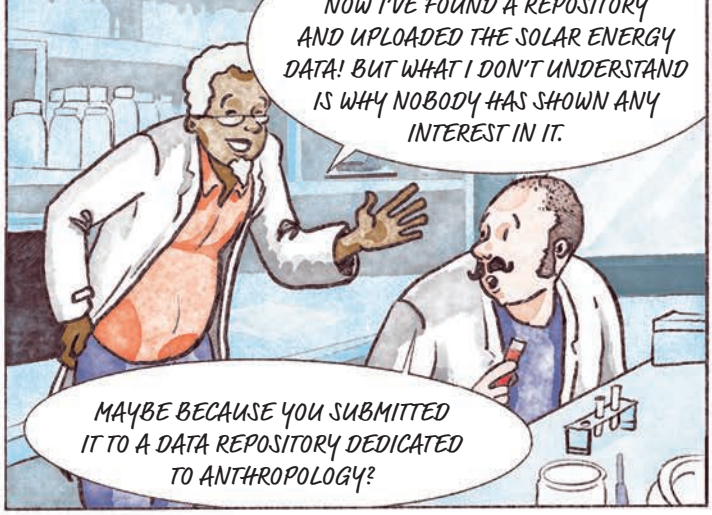


The descriptive section of a data-paper is most often comprised of nine parts:
- Title page
- Introduction
- An adequate description of the materials and methods
- A sufficient description of the data
- An information and discussion section substantiating the rigour of the data
- Advice, if necessary, on how to re-use the data
- Acknowledgements and mention of any possible conflicts of interest
- A list of bibliographical references
- Figures, charts and appendices related to methodology and data quality, or providing a synthesis of the data.

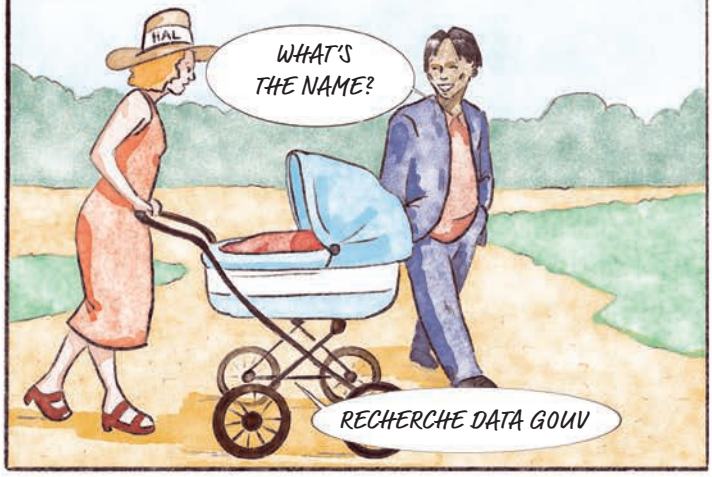


The third solution, which is also the most recommended, is to host your datasets on a dedicated data repository. A data repository is a reservoir of research data, raw or derived, that can be retrieved and re-used thanks to a metadata description.

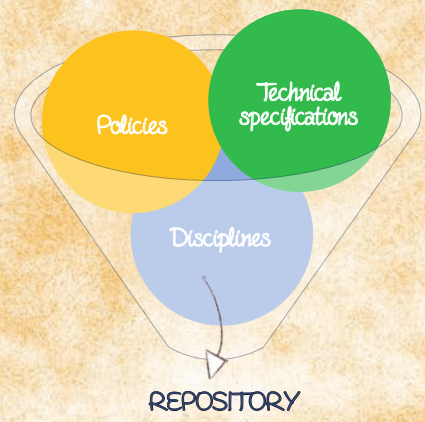
That's right! There are several thousand data repositories around the world. They fall into three main categories: disciplinary, generalist and institutional.



Since the end of 2021, France has been operating a national repository for research data, funded by the Ministry of Higher Education and Research, called Recherche Data Gouv: https://recherche.data.gouv.fr/fr

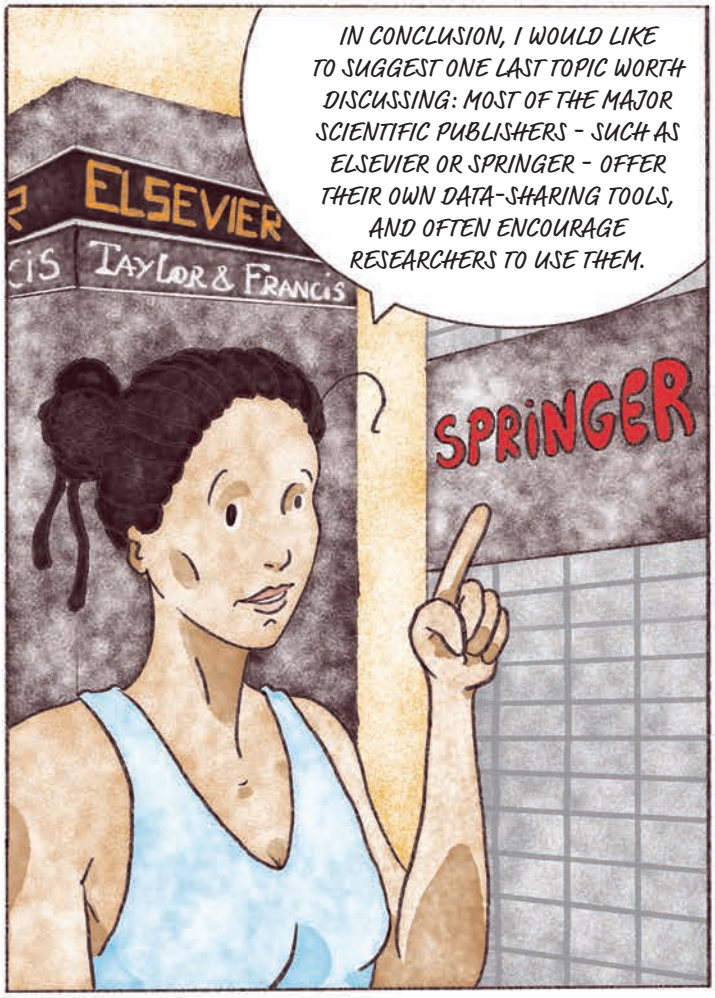


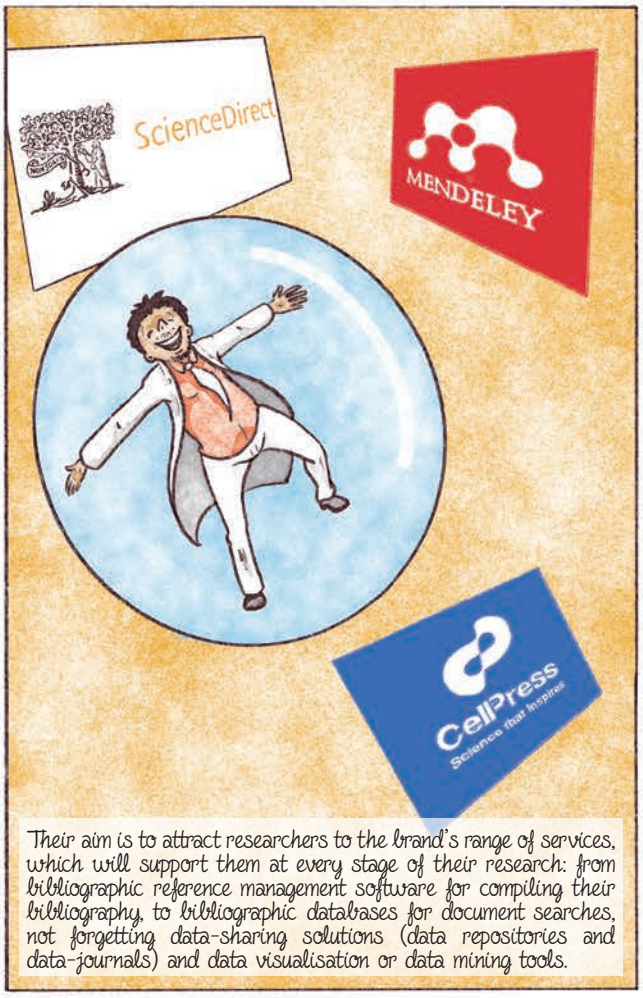
As you can see, selecting the right repository for your data is essential. This involves three main criteria: the technical specifications of the repository, whether it meets the policy requirements of funders or publishers, and the disciplinary aspect.



Regarding the technical specifications of the repositories, a certification system has been introduced to help researchers find their way around. These certifications are based on the evaluation of the repository by an independent jury on a declaratory basis. Access to the assessment file is made public to allow effective verification by users.

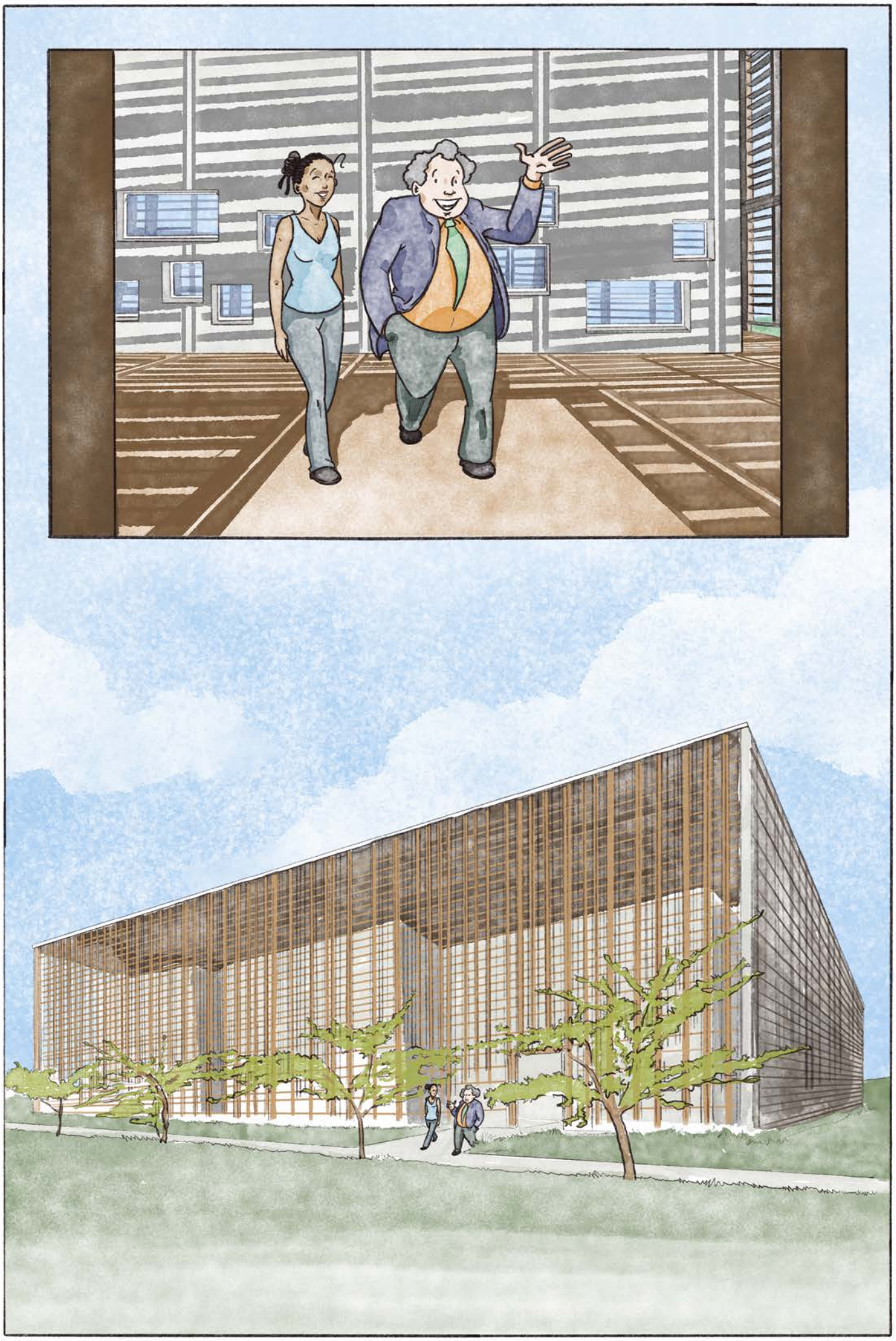
Certification attests to the repository's compliance with the "FAIR" principles. There are currently three levels of certification: 'CoreTrustSeal' is obtained after meeting 16 criteria (134 centres were certified worldwide in 2023). 'Nestor Seal' requires a commitment to 34 criteria (5 centres certified worldwide in 2023). Finally, to obtain ISO +, you have to comply with around a hundred criteria (only one certified centre worldwide in 2023)!





Their aim is to attract researchers to the brand's range of services, which will support them at every stage of their research: from bibliographic reference management software for compiling their bibliography, to bibliographic databases for document searches, not forgetting data-sharing solutions (data repositories and data-journals) and data visualisation or data mining tools.

The continuum offered can be very attractive to researchers because of its ease of use.



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