DIGITAL LIBRARY SERVICES

Doing Digital Scholarship with **D**igital **L**ibrary **S**ervices (**DLS**)

The Motivations

Wednesday, 15th May 2019, 10:00 - 11:00
Ulwazi training room

DLS Team

Digital Library Services

- Niklas Zimmer
- Sanjin Muftić
- Patricia Chikuni
- Ya'qub Ebrahim
- Thomas Slingsby

ORCID Connecting Research and Researchers

Let's change what we value in research.

Sign DORA

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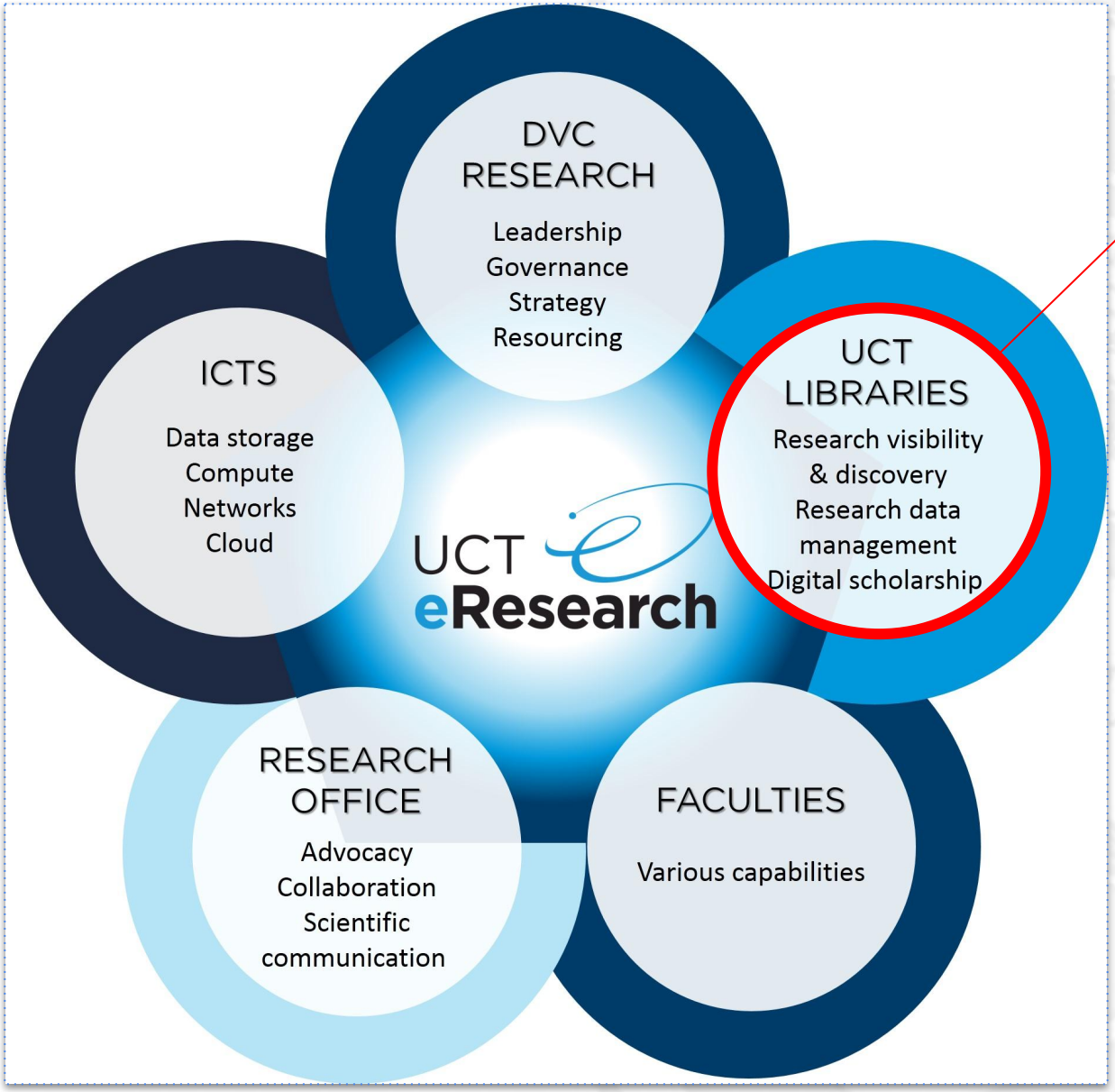
Muftić, S., Zimmer, N., Chikuni, P., Ebrahim, Y & Slingsby, T. (2019): **Doing Digital Scholarship with DLS: The Motivations**. Presentation. 10.25375/uct.8118014



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Digital Scholarship and DLS | **mission & vision**

We provide **open**, online access to primary resources for teaching, learning and research at the University of Cape Town (UCT) through digitisation, **digital scholarship**, data curation and preservation services.

We subscribe to and support the practice of **Open Science.**

Source: DLS website: http://www.digitalservices.lib.uct.ac.za/

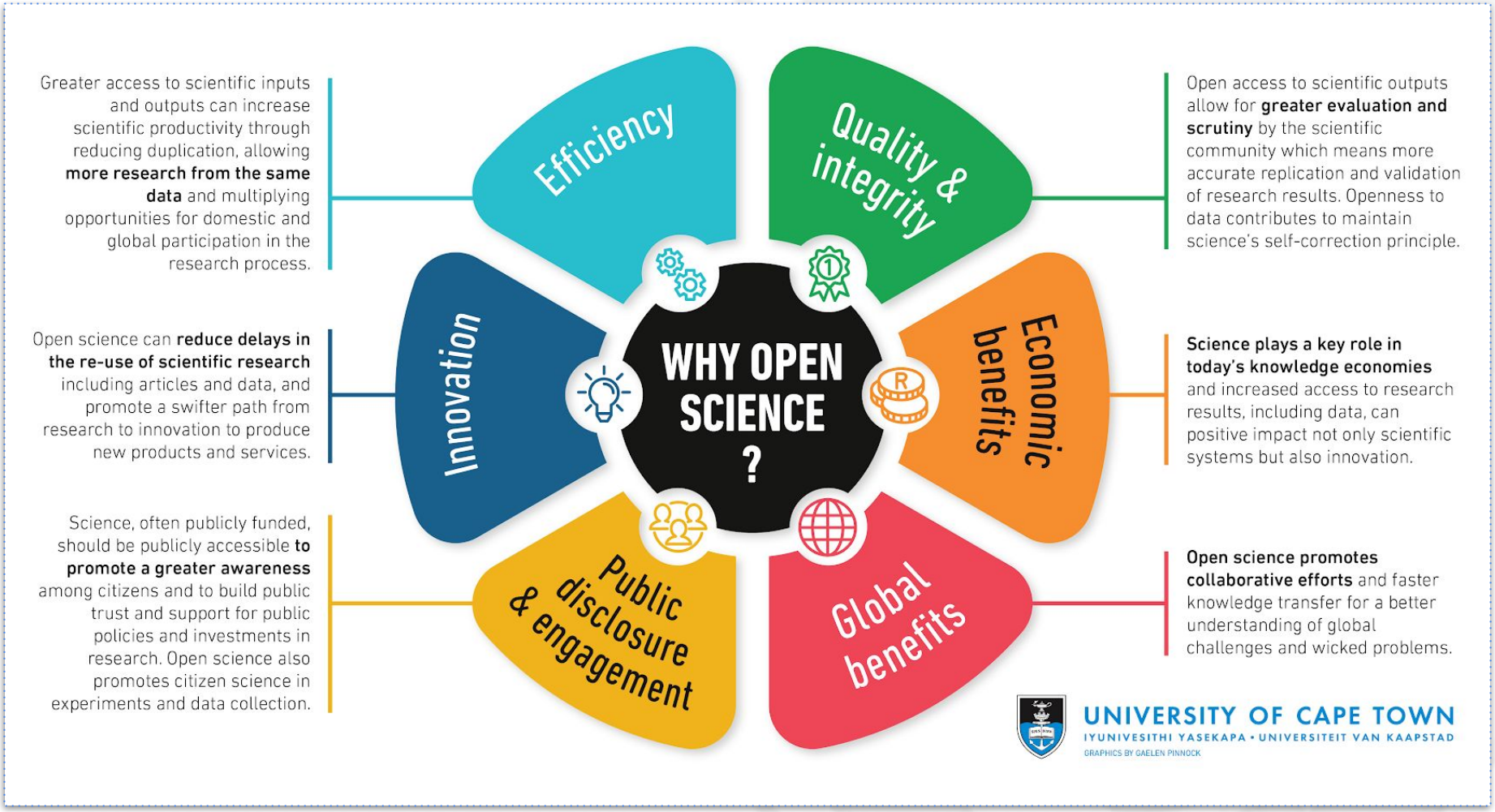
Open Science

Open Science is the movement to make scientific *research* (including publications, data, physical samples, and software) and its *dissemination* **accessible to all levels** of an inquiring society, amateur or professional.

Open Science is arguably simply proper science. Others are enabled to **collaborate and contribute**, since research data […] and other research processes are **freely available**, under terms that enable **reuse, redistribution and reproduction** of the research and its underlying data and methods and subscribe to grounded ethical practices.

Source: Foster Open Science: (https://www.fosteropenscience.eu/foster-taxonomy/open-science-definition
Adapted from: Woelfle, M.; Olliaro, P.; Todd, M. H. (2011). "Open science is a research accelerator". Nature Chemistry. 3 (10): 745–748. https://doi.org/10.1038%2Fnchem.1149

Open Science **at UCT**



Source: UCT RDM **Why Open Science**: https://commons.wikimedia.org/wiki/File:UCT_RDM_Why-Open-Science.png

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Digital Scholarship and Research Data Management
a brief overview

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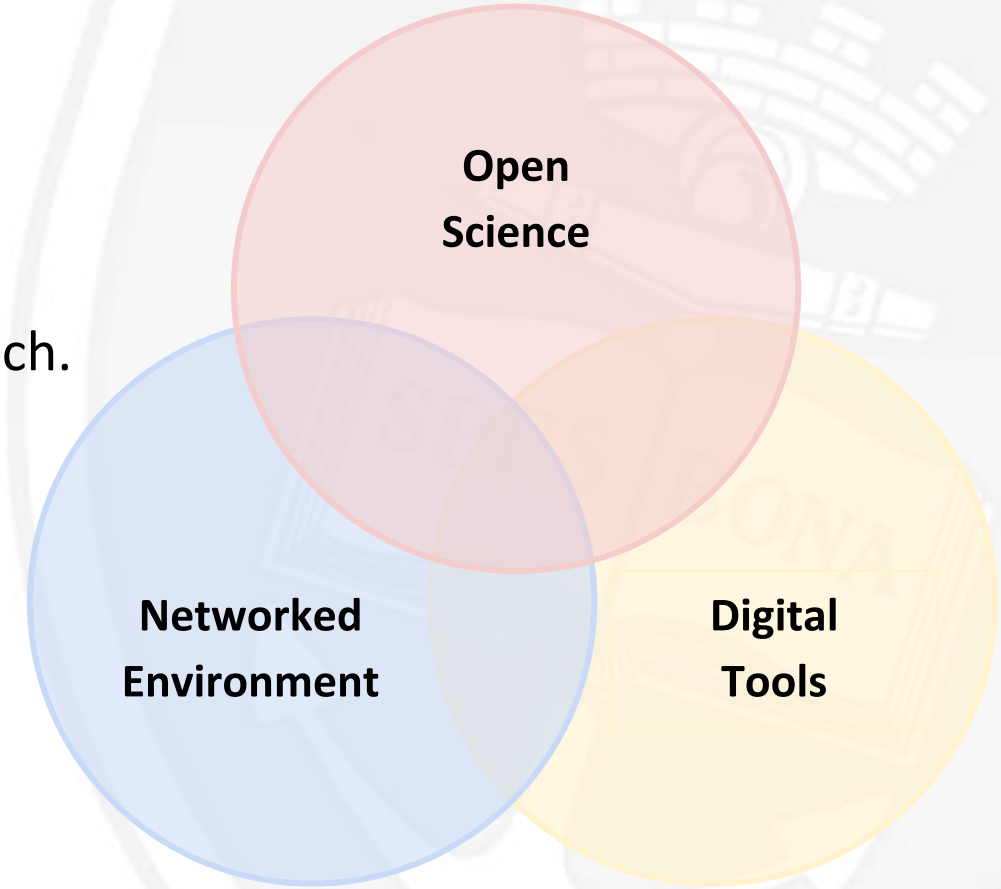
Wednesday, 15th May 2019

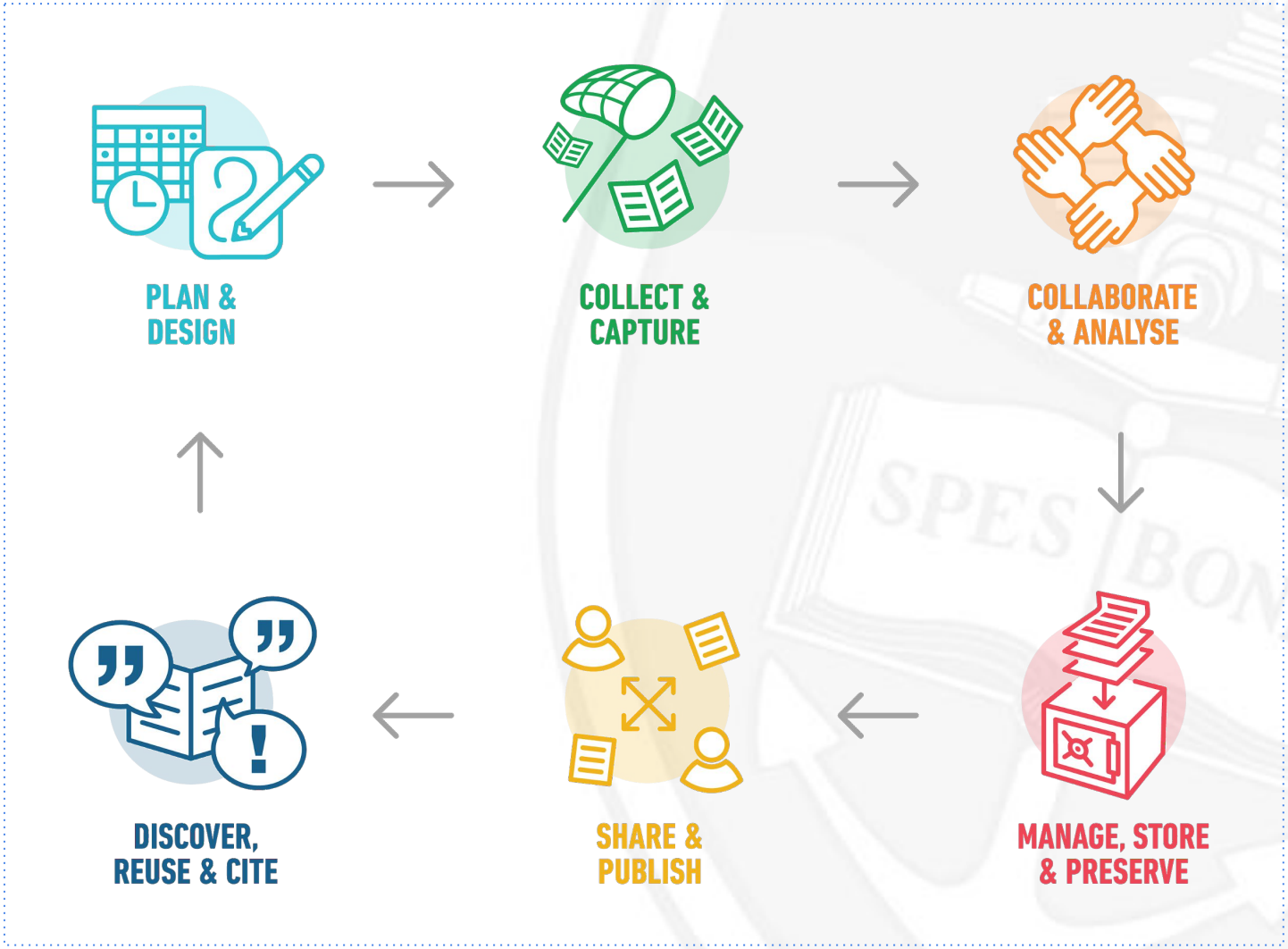
What is **Digital Scholarship**?

Digital Scholarship is the application and integration of digital tools and methods to discover, *research* and teach.



Source: Weller, M. 2011. *The Digital Scholar;* Adapted from: https://www.open.edu/openlearn/ocw/mod/oucontent/view.php?id=48677&section=2

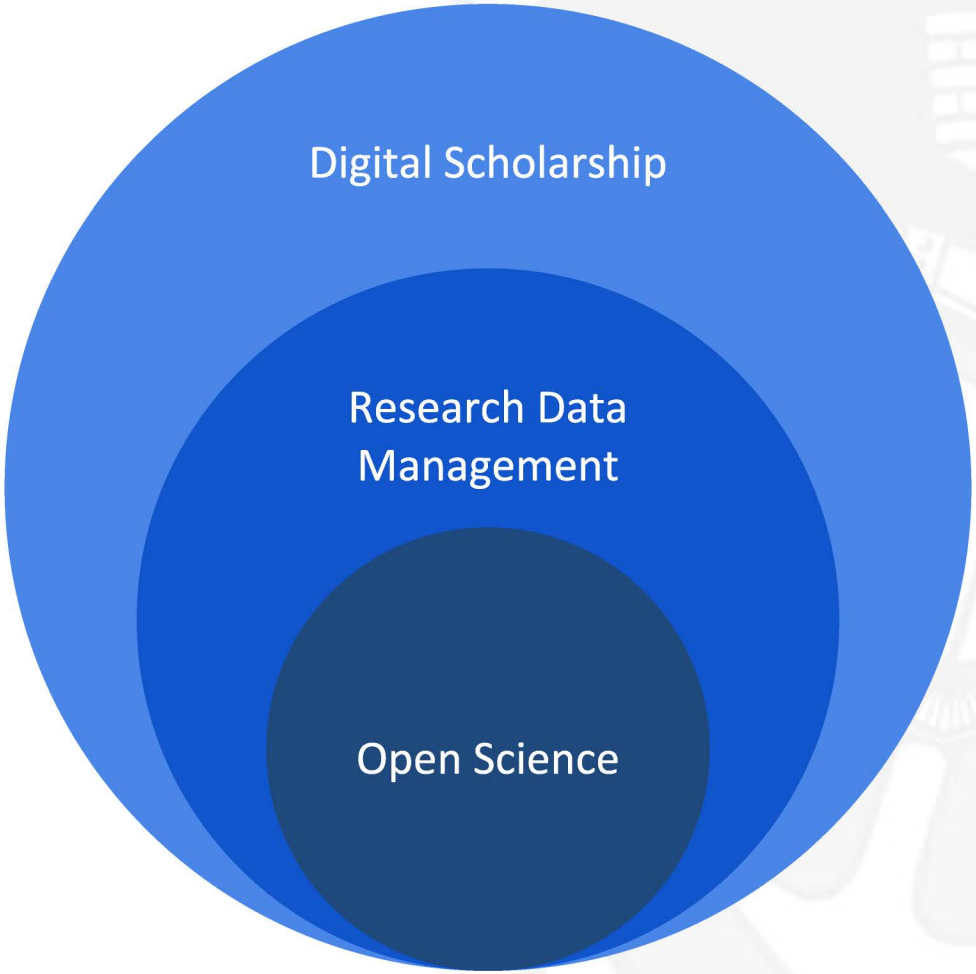
The research data management (RDM) lifecycle



What is Research data management (**RDM**)?

- The **organisation and documentation** of the data processes (collection, description, de-identification, curation, archiving and publication) within a research project.
- Already practised by researchers, but generally for internal use, and to varying degrees of professionalism.
- Part of an international drive towards **Open Science**, to professionalise data management practices, and make research more coherent and shareable.
- Good **Digital Scholarship** practices along every step of the research lifecycle.

DS - RDM - OS


Digital Scholarship
Research Data Management
Open Science

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What is (your) data and why should you make it **reusable**?

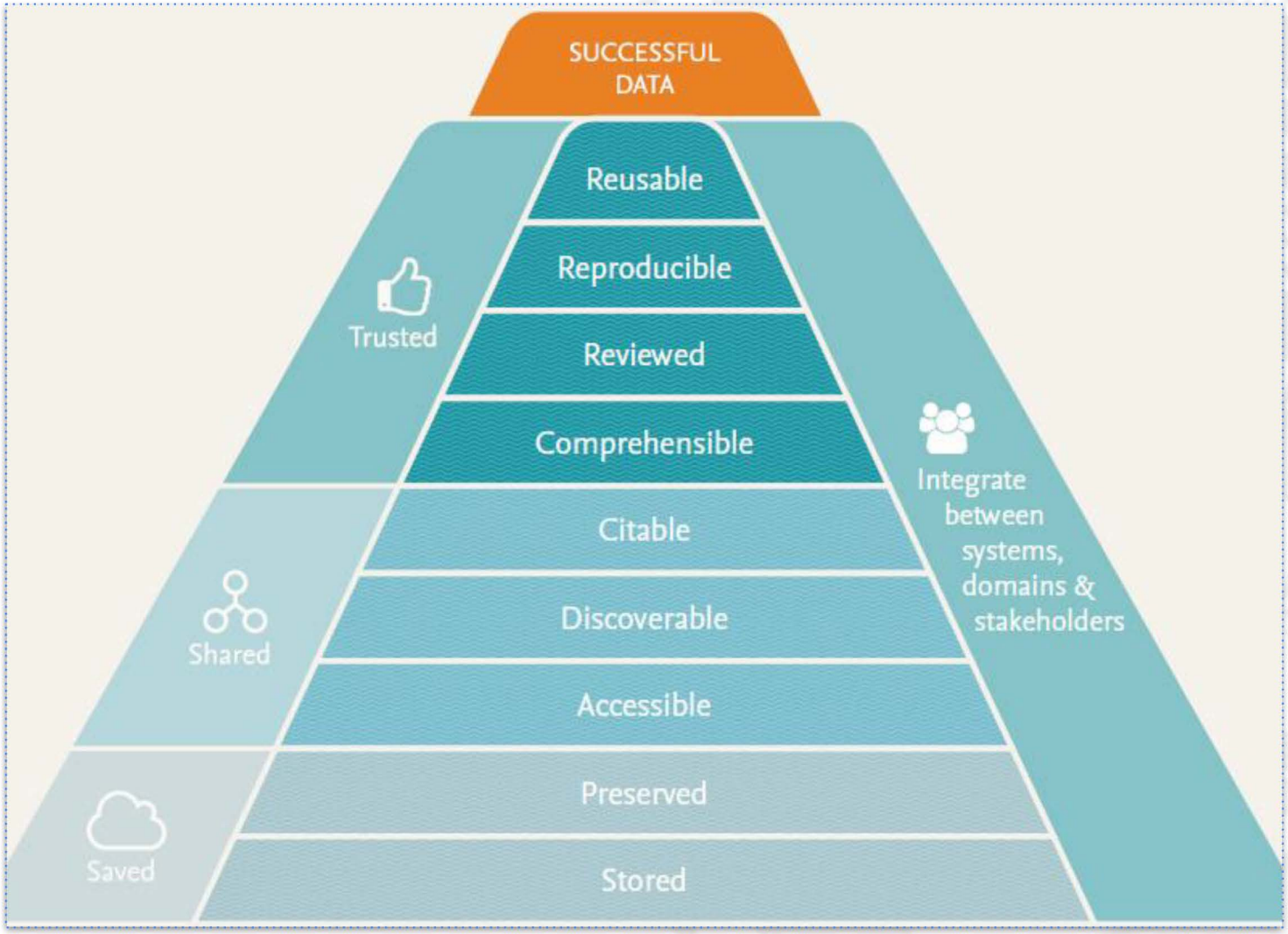
"What (are my) research data?"

Compiled from: LibGuides@ Macalester University. Available at: https://libguides.macalester.edu/c.php?g=527786&p=3608583

What is **closed** science?

Source: NYU Health Sciences Libraries. https://youtu.be/N2zK3sAtr-4

‘Good RDM makes data reusable’



Source: 10 aspects of highly effective research data - Good research data management makes data reusable By Anita de Waard, Helena Cousijn, PhD, and IJsbrand Jan Aalbersberg, PhD

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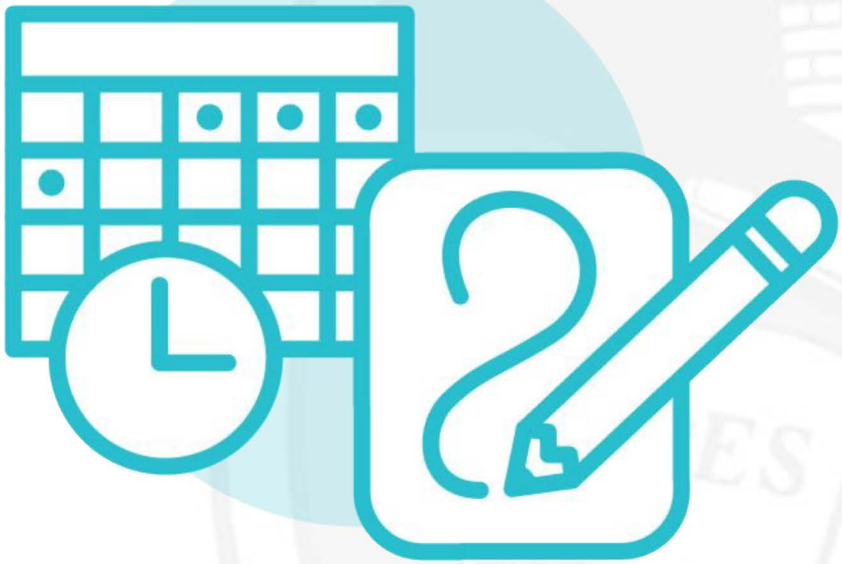
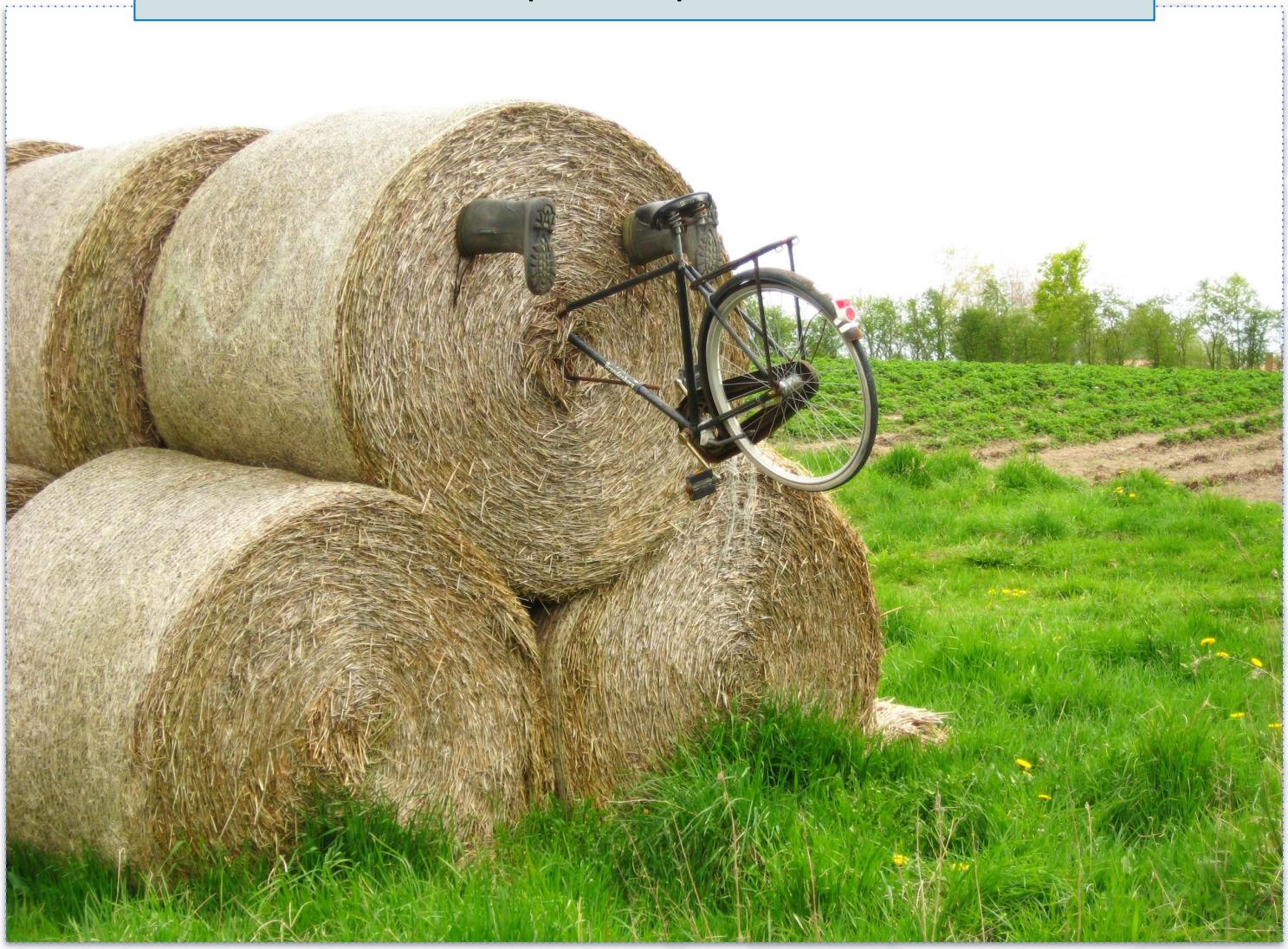
The Research Data Lifecycle

Digital Scholarship tools and methods to assist with Research Data



PLAN & DESIGN

Fail to plan … plan to fail!



Source: Tomasz Sienicki, Cycling in Denmark (2009). Available: https://commons.wikimedia.org/wiki/File:Cyklisci_dk_ubt.JPG

What is a DMP & why create one?

A **data management plan** (DMP) is a living, written document explaining what you intend to do with your data during and following the conclusion of your research project.

A DMP is already a **requirement** by many **funders** (NIH, Wellcome Trust, NRF).

Even when it is not a requirement, having made such a plan can **save you time** and **effort** during your research, as it assists you with **organising your data**, preparing it for the next step in its lifecycle, and clarifying who will have access to it, how, and when.

A DMP provides **guidance for curation-specific activities**, such as file-naming, archiving, formats suitable for long-term preservation, etc.

Adapted from: OSF Guides > Best Practices > Handling Data > **Creating a data management plan (DMP)**. Available: http://help.osf.io/m/bestpractices/l/618674-creating-a-data-management-plan-dmp

The new **student MoU** at UCT

Comply with **institutional requirements**: In 2019, a new **student MoU** (Memorandum of Understanding) was implemented for all postgraduate researchers, requiring them to create a DMP as part of the registration process:

★**E.3 Research data management policy**		
The requirement for storage of research data as specified by funders must be met - i.e. of both research and scholarship / bursaries. (See: http://www.researchsupport.uct.ac.za/managing-research-data) The supervisor and candidate should confirm that they are aware of the requirement to complete and submit a Data Management Plan (DMP) (available on the Library website http://www.digitalservices.lib.uct.ac.za/dls/rdm-planning) prior to collecting, storing, describing or analysing data. Confirm that this requirement has been complied with by indicating `Yes' below.		
Are you aware of the research data management policy?		
Supervisor		Yes ☐
Student		Yes ☐

10 January 2019 Page 6 ACA47a

Adapted from: OSF Guides > Best Practices > Handling Data > **Creating a data management plan (DMP)**. Available: http://help.osf.io/m/bestpractices/l/618674-creating-a-data-management-plan-dmp

Ethics-DMP process

Data management planning for ethics approval

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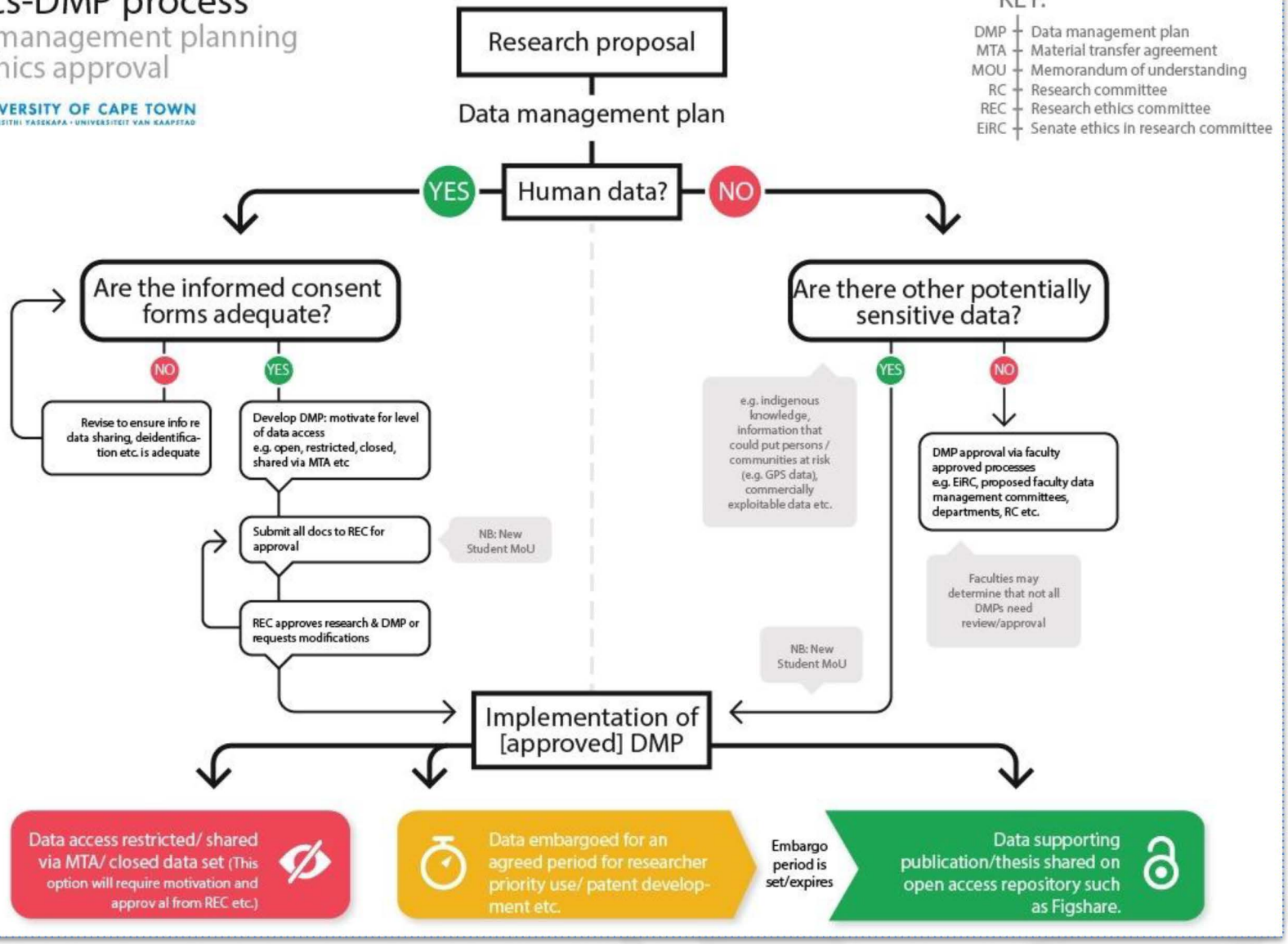
KEY:
- DMP – Data management plan
- MTA – Material transfer agreement
- MOU – Memorandum of understanding
- RC – Research committee
- REC – Research ethics committee
- EIRC – Senate ethics in research committee



accessible: https://commons.wikimedia.org/wiki/File:RDMGraphics_Ethics_final-Cropped.jpg

Simplified ‘traditional’ research process

PLAN & DESIGN

SHARE & PUBLISH

COLLECT & CAPTURE

COLLABORATE & ANALYSE

Simplified ‘modern’ research process

Data Publication

DISCOVER, REUSE & CITE

PLAN & DESIGN

SHARE & PUBLISH

COLLECT & CAPTURE

Final Data Management Plan

MANAGE, STORE, PRESERVE

Initial Data Management Plan

COLLABORATE & ANALYSE

Additional benefits of creating a DMP

- **Enhance your reputation**: Well documented, clean and organized data can lead to new collaboration and funding opportunities.
- If you plan on sharing your data, a DMP can help you work through the issues you need to address to make sharing possible.
- Finally, a DMP helps ensure that your data remains **useable** to yourself, your collaborators, and other researchers in future.

Adapted from: OSF Guides > Best Practices > Handling Data > **Creating a data management plan (DMP)**. Available: http://help.osf.io/m/bestpractices/l/618674-creating-a-data-management-plan-dmp

DMPonline

https://dmp.lib.uct.ac.za/

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My plan (Gender, Health and Justice Research Unit)

Plan details | GHJRU DMP | Share | Export

This page gives you an overview of your plan. It tells what your plan is based on and gives an overview of the questions that you will be asked.

Plan name	My plan (Gender, Health and Justice Research Unit)
ID	-
Grant number	-
Principal Investigator/Researcher	Ya'qub Ebrahim
Plan data contact	-
Description	-

This plan is based on:

Institution	University of Cape Town (UCT-Generic)

Sections	Questions
1. Project name	- Insert the name of your project proposal.
2 Introduction/type of study	- Provide a summary of the written description of the proposed study. Include the study's objectives, design, and methods.
3. Description of existing data	- Provide if possible a survey of previously existing data relevant to the project; the nature and scale of such data; and a brief discussion of whether and how these data will be integrated or the gaps in these datasets the new study will fill.
4. Data collection and generation	- TYPES OF DATA/DATA OUTPUTS - Describe what types of data will be collected. Indicate whether the data will be qualitative or quantitative and the likely file formats in which the data will be collected. Indicate if there is an intention to convert file formats for long-term accessibility and preservation. - METHODOLOGIES FOR DATA CREATION/GENERATION - Describe the how data will be collected for this study. - QUALITY MANAGEMENT - Describe the quality control (QC) measures and quality assurance (QA) measure you will implement.
5. Data management, documentation and curation	- MANAGING, STORING AND CURATING DATA - Indicate how you will be storing and curating your electronic and paper/hard copy data. Focus on principles and systems with brief examples, and avoid long lists. - DATA DOCUMENTATION - Indicate what additional documentation (aside from the DMP) if any will accompany the dataset to support future users. - FILE NAMING CONVENTIONS - Indicate the naming convention for your data files. - DATA ARCHIVING - Outline your plans for storage/archiving of the final datasets. - ETHICS AND PRIVACY - Indicate how informed consent will be handled in your project.

Pick from a variety of templates (funder-specific or generic, i.e. 'UCT') to assist you with planning how you will collect, store, manage and analyse your research data during your research project.

DMPonline

https://dmp.lib.uct.ac.za/

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My plan (Gender, Health and Justice Research Unit)

0/18 questions answered

approx. 15% of available space used

Plan details | **GHJRU DMP** | Share | Export

1. Project name (1 question, 0 answered) +

2 Introduction/type of study (1 question, 0 answered) +

3. Description of existing data (1 question, 0 answered) +

4. Data collection and generation (3 questions, 0 answered) −

TYPES OF DATA/DATA OUTPUTS - Describe what types of data will be collected. Indicate whether the data will be qualitative or quantitative and the likely file formats in which the data will be collected. Indicate if there is an intention to convert file formats for long-term accessibility and preservation.

B *I* | ≡ | 1≡ | 🔗 | ⊞

Save

Not answered yet

Guidance | Add comment

UCT Guidance −

Data collected and stored by the GHJRU typically includes the following:

- In-depth interview audio files (mp3) and transcripts (MS word documents)
- Focus group discussion audio files (mp3) and transcripts (MS word documents, Nvivo files)
- Notes from in-depth interviews and focus group discussions, and other fieldnotes (MS word documents, Nvivo files)
- Quantitative survey data: both electronic (CSV, STATA, SPSS) and paper
- Minutes of research meetings—to be considered "data" only if collected as the result of a research process (Microsoft word documents)

Accessibility and preservation

Open and machine-readable formats help preserve data in the long term. Consider converting text files into RTF, PDF or XML format, quantitative data into CSV, and audio files into WAV to ensure they are accessible for future users and software systems.

Useful information is provided at every step.

METHODOLOGIES FOR DATA CREATION/GENERATION - Describe the how data will be collected for this study.

B *I* | ≡ | 1≡ | 🔗 | ⊞

Guidance | Add comment

UCT Guidance +

Typical DMP questions

- **What type of data** will be generated in your research?
- How will your data be **named and referenced**?
- What **file formats** are involved?
- What data and **metadata standards** will you follow?
- Who will **have access** to your data?
- How and when will you **share** your data, if applicable?
- Will you be **digitally preserving** your data? If yes, how so?
- How will you **license** your datasets?
- How will you ensure **privacy** or **confidentiality**, if applicable?

Adapted from: OSF Guides > Best Practices > Handling Data > **Creating a data management plan (DMP)**. Available: http://help.osf.io/m/bestpractices/l/618674-creating-a-data-management-plan-dmp

COLLECT & CAPTURE

Advice for the Collect & Capture Process

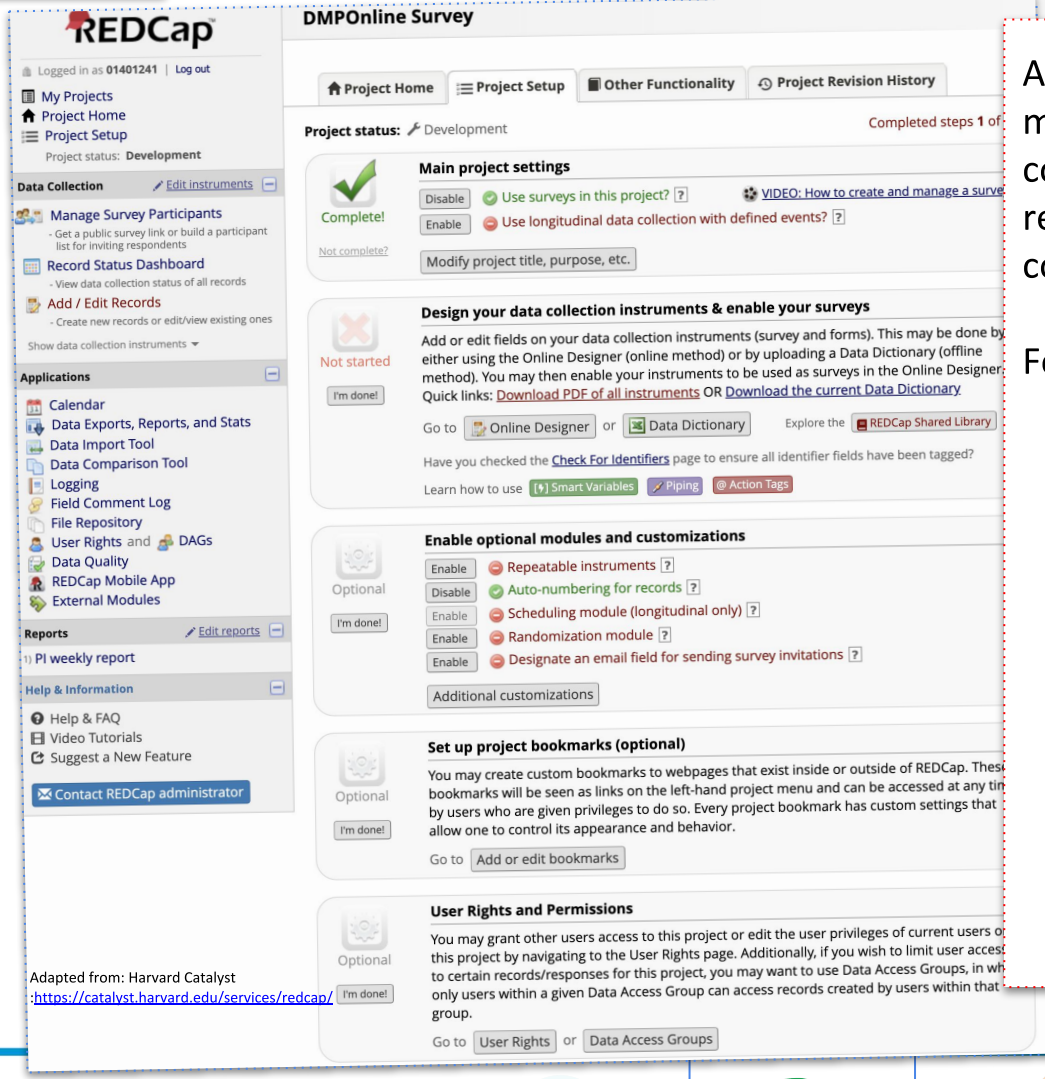
While collecting and capturing your data, make sure that you document it with correct, meaningful **metadata:**

- Describe the type of data generated:
  - The **form** (*What kind of data does it hold?*)
  - The **stability** of each dataset (*How does it change over time?*)
  - Create **unique names** for each of your datasets
- Document the data you are capturing, and how you are identifying it within each data set by building a **data dictionary**.
- Practice good **file naming conventions**.
- **Document your process** and store it together with your data (e.g. readme.txt).

Adapted from: OSF Guides > Best Practices > Handling Data > **Creating a data management plan (DMP)**. Available: http://help.osf.io/m/bestpractices/l/618674-creating-a-data-management-plan-dmp

RedCap

https://trn-redcap.uct.ac.za/



Adapted from: Harvard Catalyst :https://catalyst.harvard.edu/services/redcap/

A secure web application for building and managing online surveys and databases, useful for collecting and tracking information and data from research studies, scheduling study events and conducting surveys.

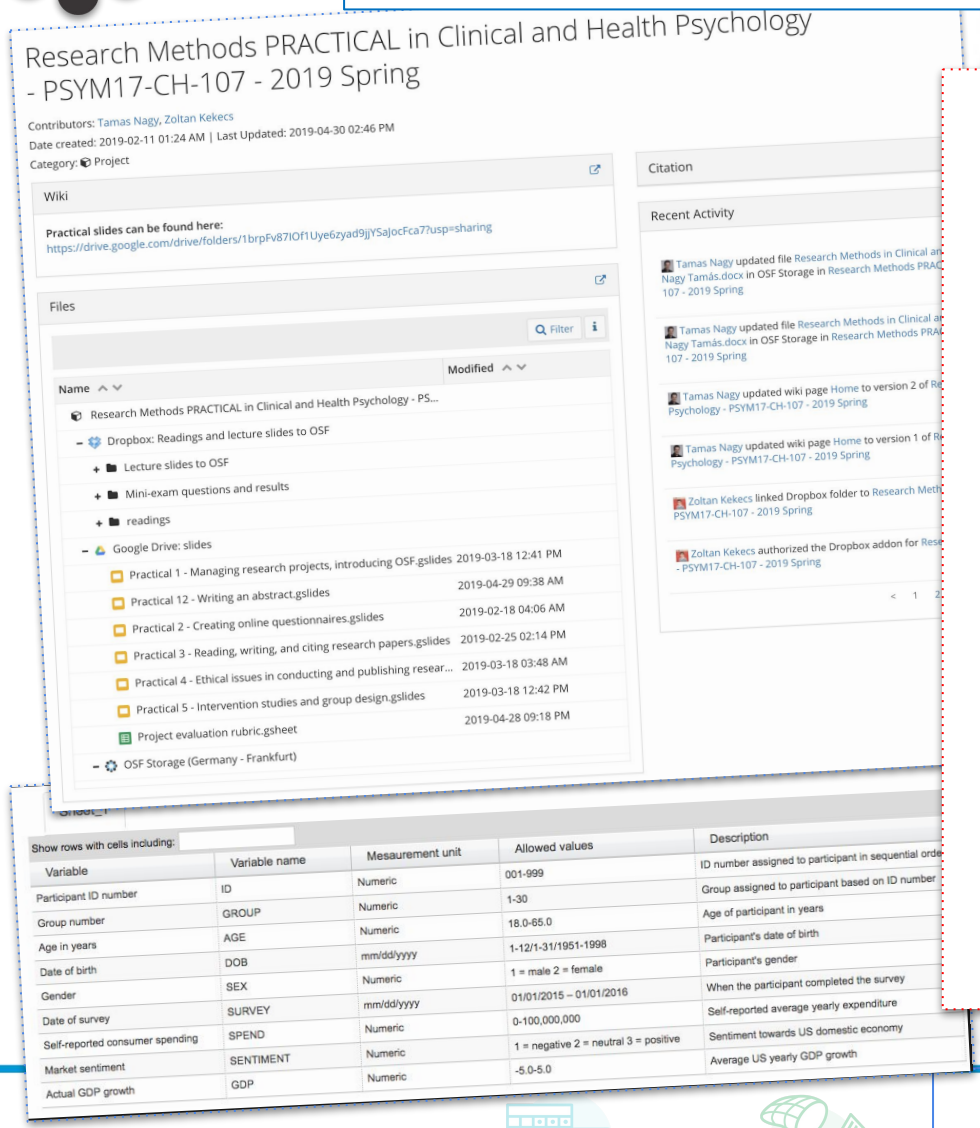
Features:

- input data from anywhere in the world
- projects can be used by researchers from multiple sites and institutions
- total control of shaping your database or survey
- data may be imported from external data sources to begin a study or to provide mid-study data uploads
- export survey results to common data analysis packages
- generate a PDF version for printing in order to collect responses offline

COLLABORATE & ANALYSE

Open Science Framework (OSF)

https://osf.io/institutions/uct/



- free, online platform that allows you to register your project, manage stakeholders, and centralise data that might be stored at different locations with different collaborators
- allows integrations with Google Drive, Dropbox, OneDrive, figshare, and many more
- provides unlimited, free storage
- helps with creating versions of your project at different stages (‘forking’)
- includes wiki-components for ease of documentation and description, including the development of a data dictionary

Advanced digital scholarship

Data Analysis and Mining:

Tools that help you identify patterns in large volumes of data, combining statistics, AI and machine learning.

- Tools and processes for data de-identification, to safeguard privacy of patients.
- Tools and process for text analysis.

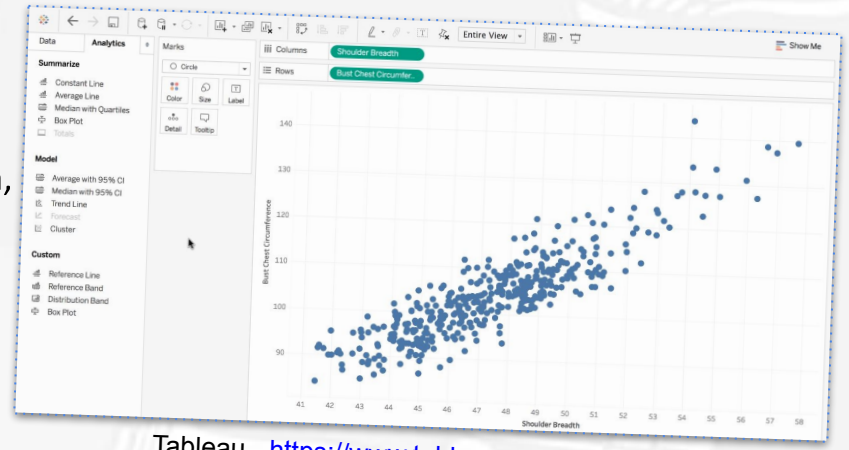
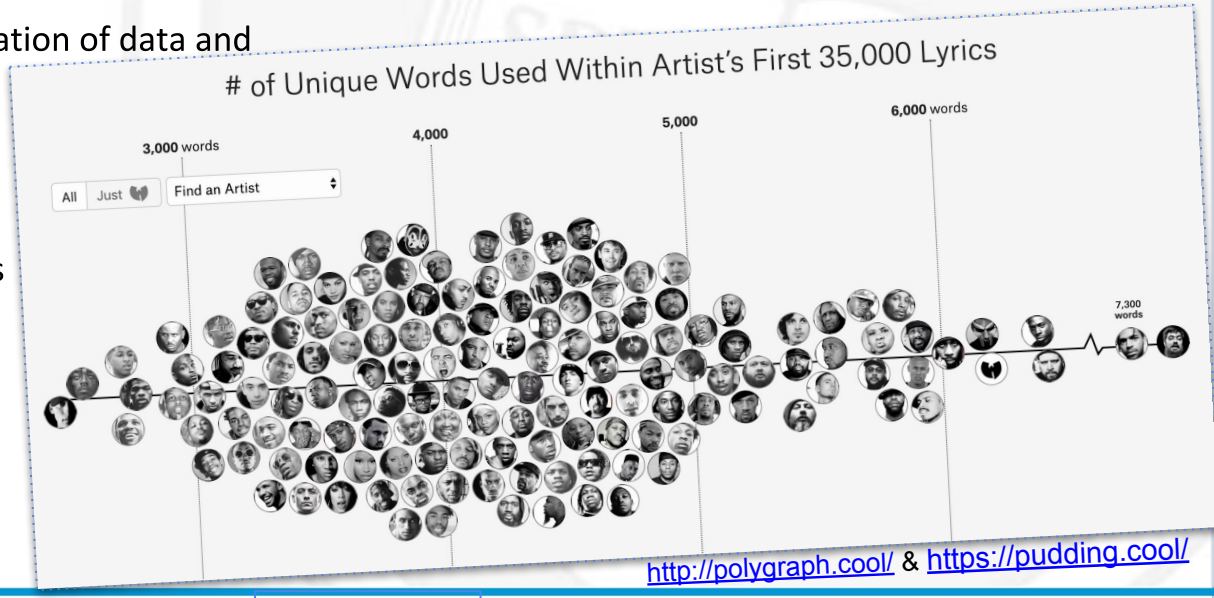


Tableau - https://www.tableau.com/

Data Visualization:

Tools that develop a graphical presentation of data and information through visual means.

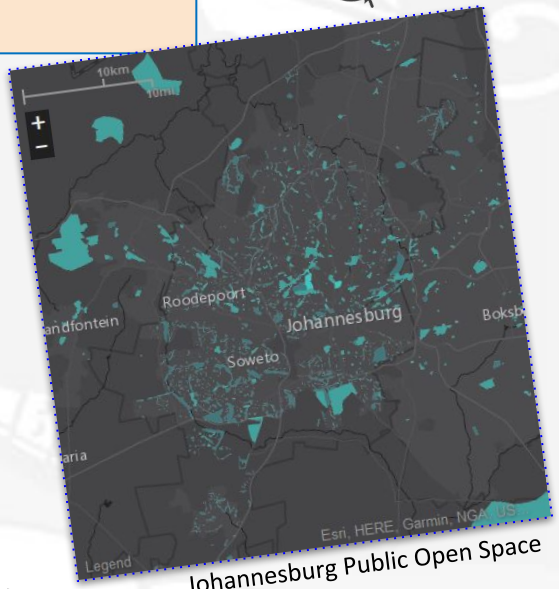


http://polygraph.cool/ & https://pudding.cool/

Digital Humanities:

Tools, processes and critical awareness found in the intersection between digital technologies and fields of study within the humanities.

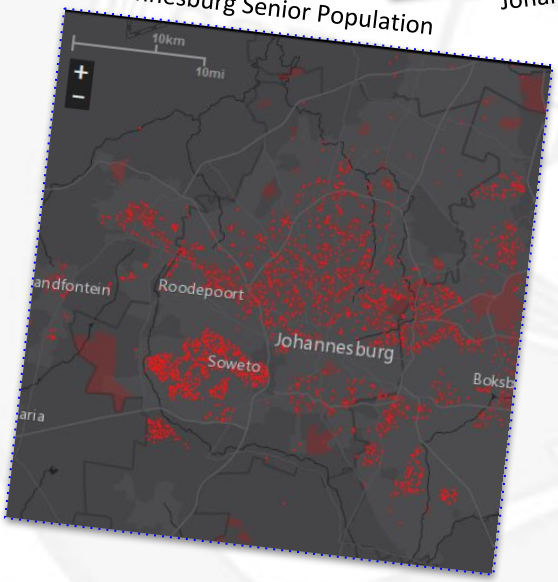
Geographic Information Systems



Johannesburg Public Open Space

Everything Happens Somewhere:

- Because everything happens somewhere everything can be associated with a spatial location.
- These locations can be mapped in space, either for simple visualisation or for complex analyses.



Johannesburg Senior Population

Data Visualisation (Maps):

- Maps are an incredibly powerful visualisation tool which allow us to view and display our data in interesting and informative ways. They allow us to see patterns in our data, not just find them.
- They also allow us to communicate our findings in a clear and succinct manner.

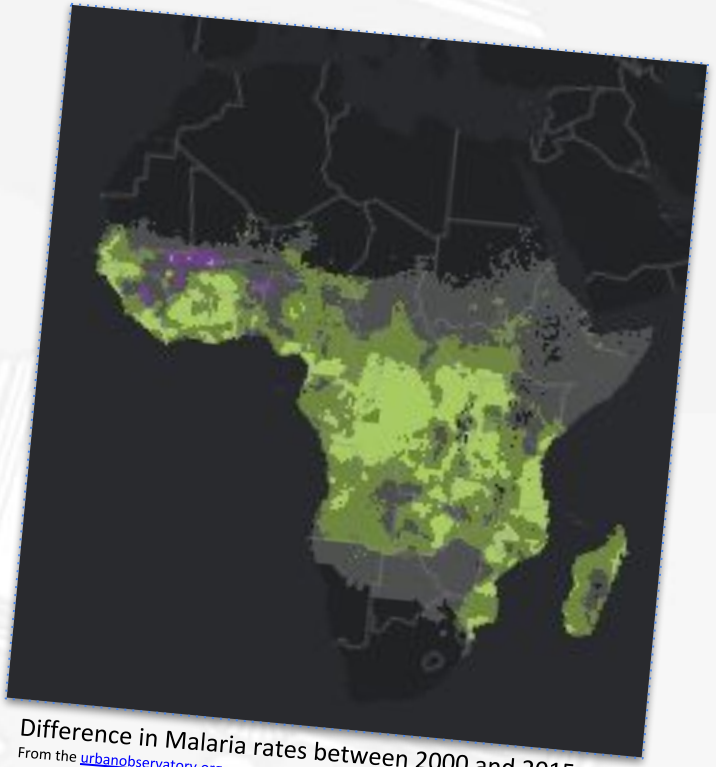
Images sourced from UrbanObservatory.org's App

GIS

Data Analysis (Making Information):

The full potential of GIS is realised when performing spatial analyses. Different types of analyses exist to satisfy various needs:

- **Overlay** Analysis allows us to compare different data types, e.g. Mean Annual Rainfall and Crop Type.
- **Geostatistical** Analysis allows us to perform statistical analyses of correlated spatial data, e.g. Hotspot Analysis.
- **Network** Analysis allows us to calculate travel times and service delivery areas, e.g. “Golden Hour” coverage or Clinic’s Service Area.
- **Dashboards** of real time sensor feeds for live monitoring, e.g. Resource Usage; Traffic Volumes; Fleet Management.



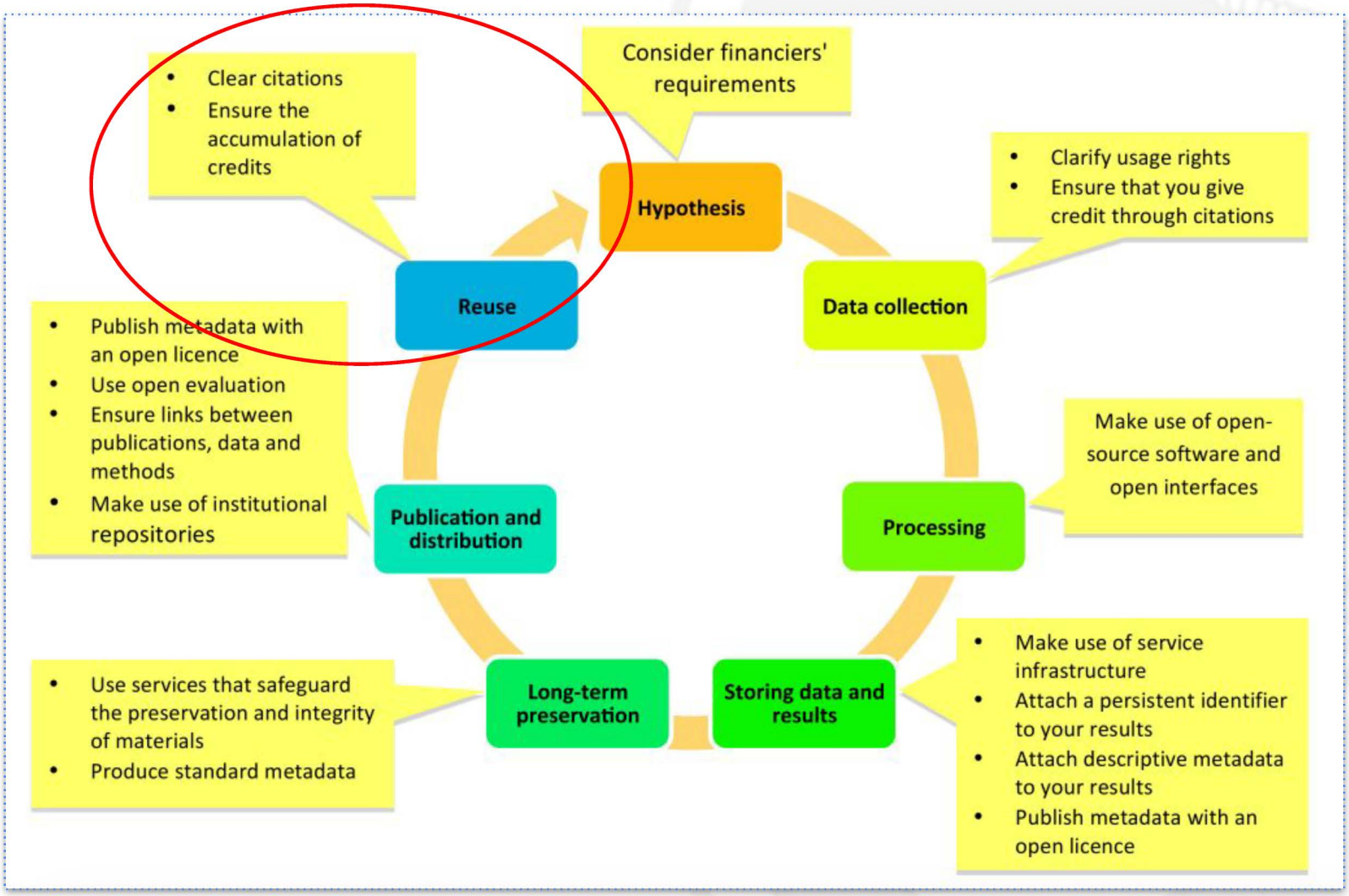
Difference in Malaria rates between 2000 and 2015.
From the urbanobservatory.org

DLS’ GIS services assist with GIS software acquisition, project planning, troubleshooting, analysis and cartographic design.

Find us @ www.gis.uct.ac.za

DISCOVER, REUSE & CITE

Open discovery, reuse and citation



Source: Foster Open Science: **What is Open Science?** Figure 1. **Promoting openness at different stages of the research process.** https://www.fosteropenscience.eu/content/what-open-science-introduction

Two research data repositories **at UCT**

DataFirst and **ZivaHub** are **registered**, **certified**, and **transparent**, through **independent review**, **standards**, and **policies**.

Adapted from: Zimmer, Niklas; King, Thomas (2018): **Data discovery and re-use**. figshare. Presentation. https://doi.org/10.25375/uct.7358423.v1

A *small* overview of data catalogues, registries and repositories

directly UCT-relevant

- BioLINCC – Clinical specimen database.
- Dataverse – Widely used open source repository system; Example: HARVARD Dataverse
- dataMED – prototype biomedical data search engine to discover data sets across data repositories or aggregators.
- Code Ocean – Cloud-based computational platform which provides a way to share, discover and run published code.
- ContentMine – Uses machines to liberate 100,000,000 facts from the scientific literature.
- DataBank – Analysis and visualisation tool that contains collections of time series data on a variety of topics.
- DataCite – **Establish easier access to research data by providing persistent identifiers for data.**
- Datahub – Publish or register datasets, create and manage groups and communities
- Dataverse Network – Harvard-based tool to share, cite, reuse and archive research data.
- Deveo – Free, private Git, Mercurial, and SVN repository management platform.
- Dryad – Data repository system for any files associated with any published article in the sciences or medicine.
- Figshare(.com) – **Free cloud service for managing, sharing & publishing research data.**
- GenBank – Gene sequence database provided by the National Center for Biotechnology Information.
- GitHub – Online software project hosting using the Git revision control system.
- How Can I Share It – Information and tools to ensure your articles can be shared with your colleagues easily.
- Open Science Framework – **Open registration, version control & collaboration software system.**
- Quip – Combines chat, documents, spreadsheets, checklist, and more to collaborate on any device.
- re3data – **Global registry of research data repositories.**
- Research Compendia – Tools for researchers to connect data, code & computational methods to published research.
- SlideShare – Community for sharing presentations and other professional content.
- Zenodo – **A home for the long-tail of science, enabling researchers to share and preserve any research outputs.**
- ZivaHub | Open Data UCT – UCT's digital repository.

Adapted from: Zimmer, Niklas; King, Thomas (2018): **Data discovery and re-use**. figshare. Presentation. https://doi.org/10.25375/uct.7358423.v1

5 ★ Open Data [**Tim Berners-Lee**]

★

make your stuff available on the Web (whatever format) **under an open license**

★★

make it available **as structured data** (e.g., Excel instead of image scan of a table)

★★★

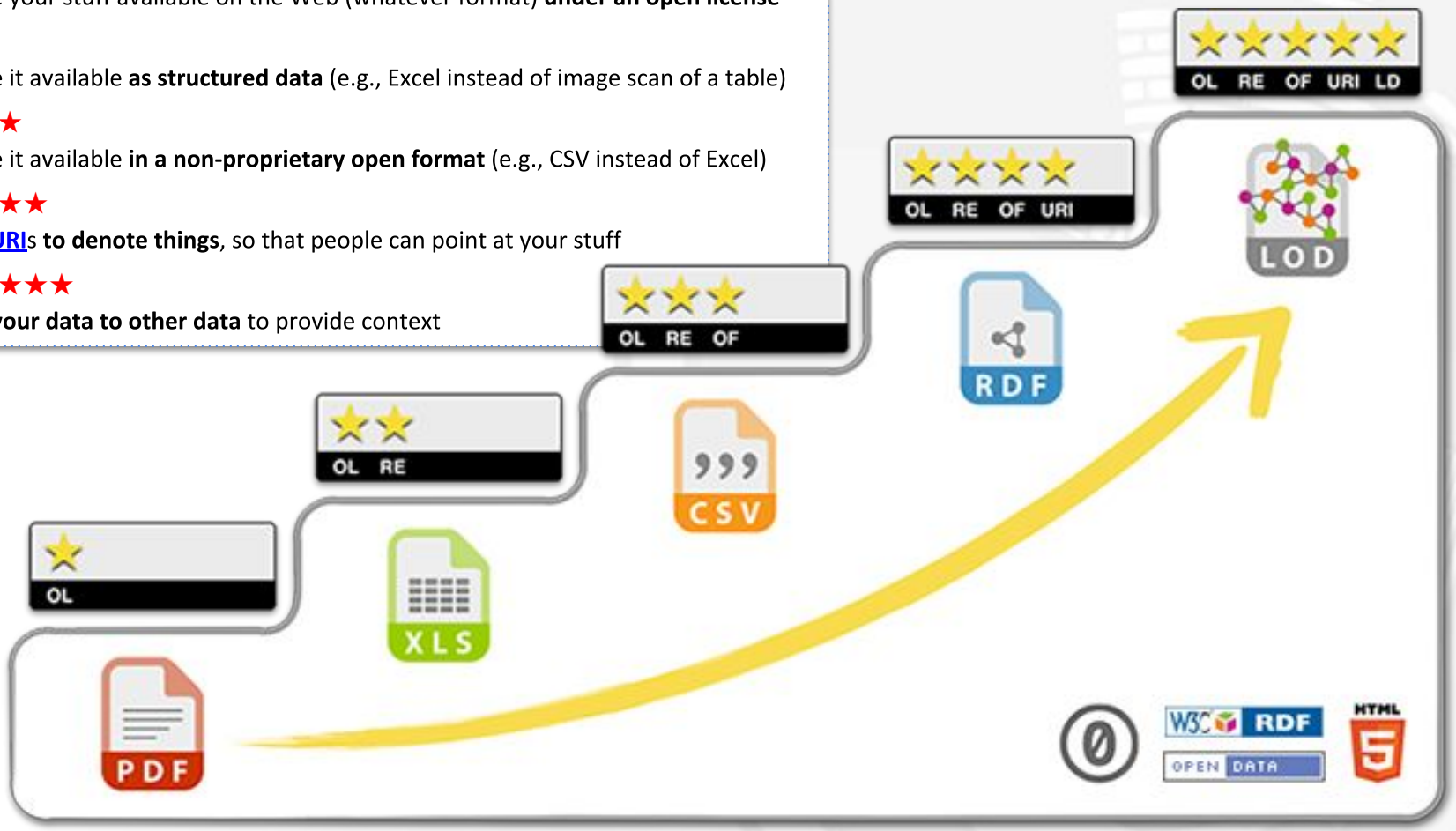
make it available **in a non-proprietary open format** (e.g., CSV instead of Excel)

★★★★

use URIs to denote things, so that people can point at your stuff

★★★★★

link your data to other data to provide context



Source: https://5stardata.info/en/

Working with the **FAIR** guiding principles

Findable

- Describe your data in a data repository
- Receive a persistent identifiers (e.g. uct doi provided by ZivaHub)

Accessible

- Consider what can be published
- Obtain participant consent
- Perform de-identification / anonymisation

Interoperable

- Use open formats
- Apply consistent vocabulary
- Use common/disciplinary metadata standards

Reusable

- Consider permitted use
- Apply machine-readable open licenses (e.g. CC-BY etc.)

Adapted from: Zimmer, Niklas; King, Thomas (2018): **Data discovery and re-use**. figshare. Presentation. https://doi.org/10.25375/uct.7358423.v1

SHARE & PUBLISH

What Stops you from sharing data?

1. **Misinterpretation** of the data.
2. **Misappropriation** of the data.
3. Damage to the researcher's **reputation** (CODATA-ICSTI, 2013).
4. **Myths** that scientific findings using shared data cannot be published in high impact journals (Milham, et.al 2018).

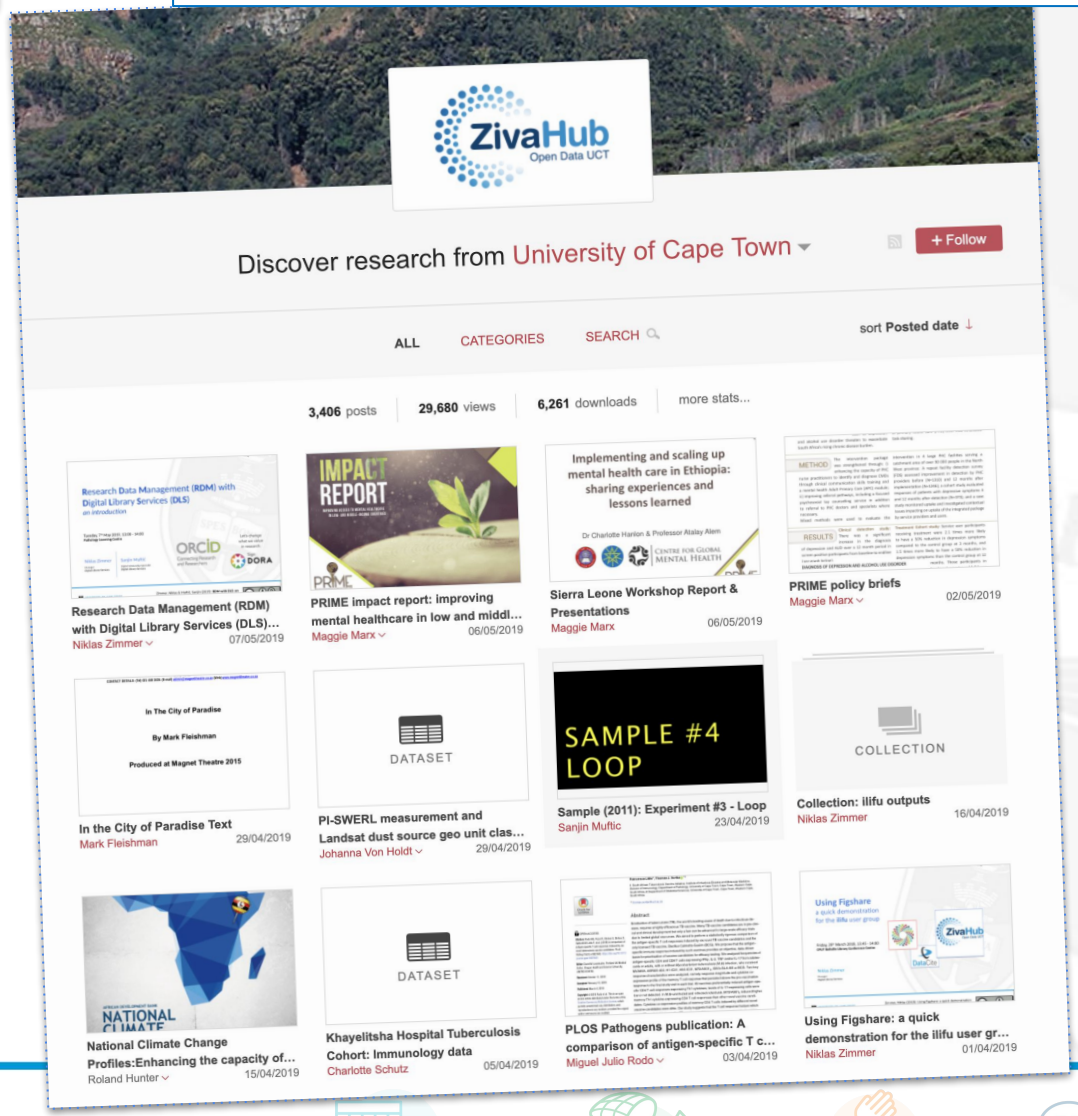
*However these fears immediately disappear the moment the data are properly managed and documented (CODATA-ICSTI, 2013).

Why share your research data?

1. **Funding agencies and institutions** now require the results of scientific studies to be shared with the public as a condition for providing grants or awards.
2. **Publishers** are now asking authors to deposit some datasets in public platforms.
3. To **confront some of the biases in data collection and analysis** (Atici et. al, 2013).
4. To **reproduce** or to **verify** research.
5. To enable others to **ask new questions** of extant data.
6. To **advance the state of research** and innovation (Borgman, 2012).
7. To **increase citation rate** (Piwowar, Day and Fridsma, 2007).
8. Sharing on platforms like Figshare **increases the visibility of individual researchers and their work online** (Peters et al., 2015).

ZivaHub | Open Data UCT

https://zivahub.uct.ac.za/



- **a repository to store and openly disseminate data**
- powered by *Figshare for institutions*
- keeps track of views, downloads and citations
- allows search across *all* Figshare platforms

ZivaHub | Open Data UCT

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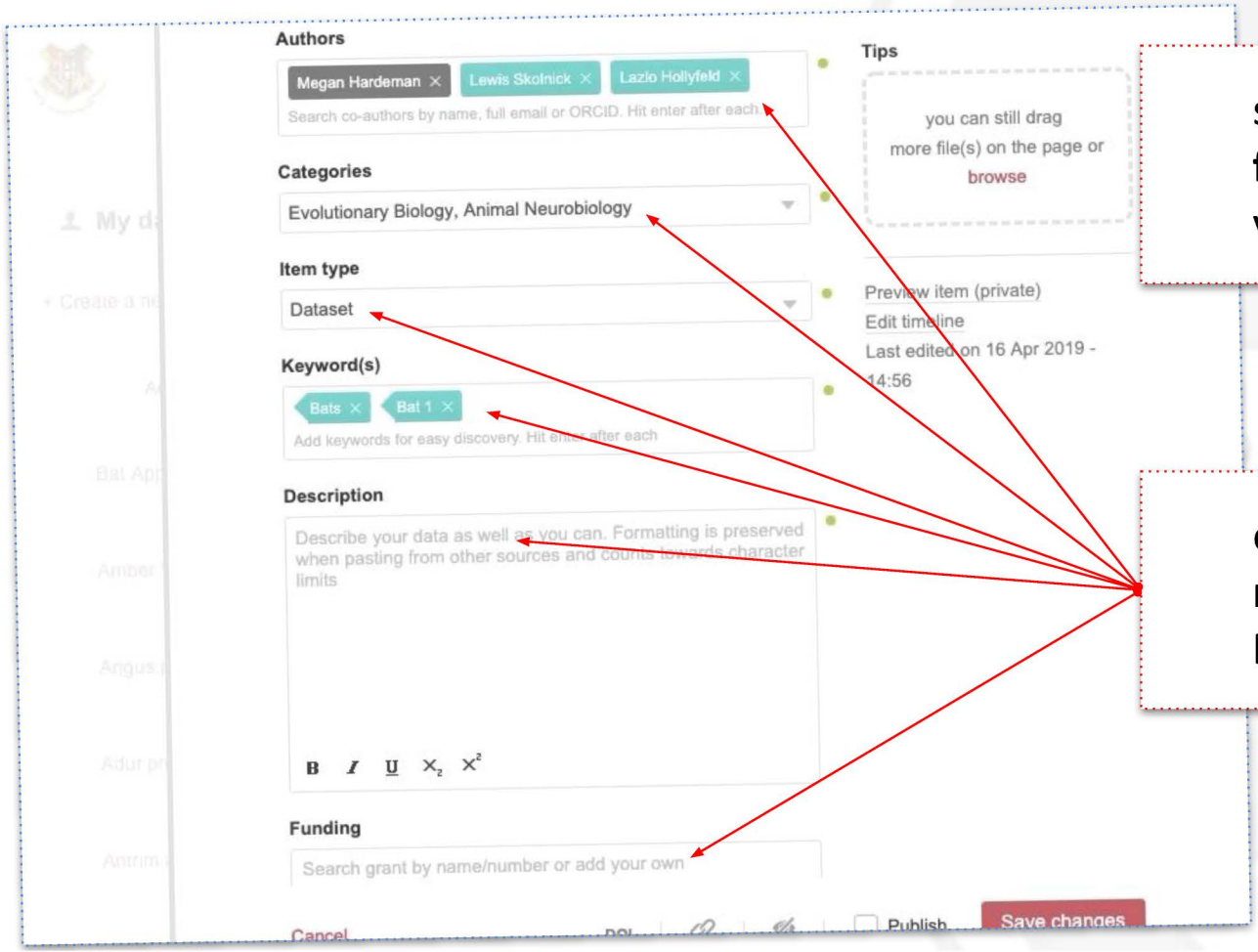


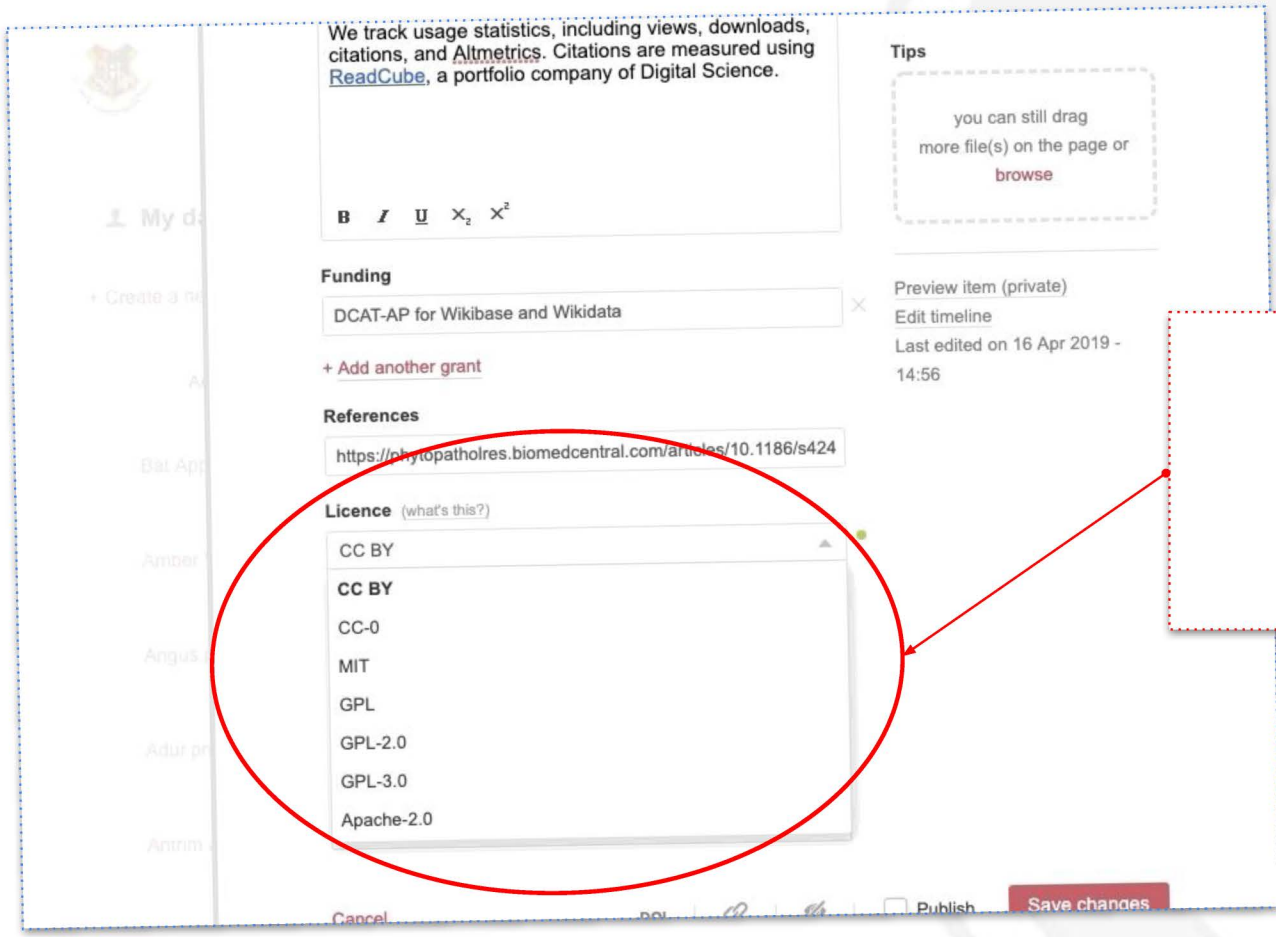
supports the upload of **any file format**, and aims to visualise all of them

embeds relevant **metadata**, to make data **FAIR** compliant

Source: Figshare. **End User Guide GIFs**. Available: https://figshare.com/s/b3600c85f576d88d067b

ZivaHub | Open Data UCT

https://zivahub.uct.ac.za/



choose from a range of **licensing options** when publishing your data openly

Source: Figshare. **End User Guide GIFs**. Available: https://figshare.com/s/b3600c85f576d88d067b

ZivaHub | Open Data UCT

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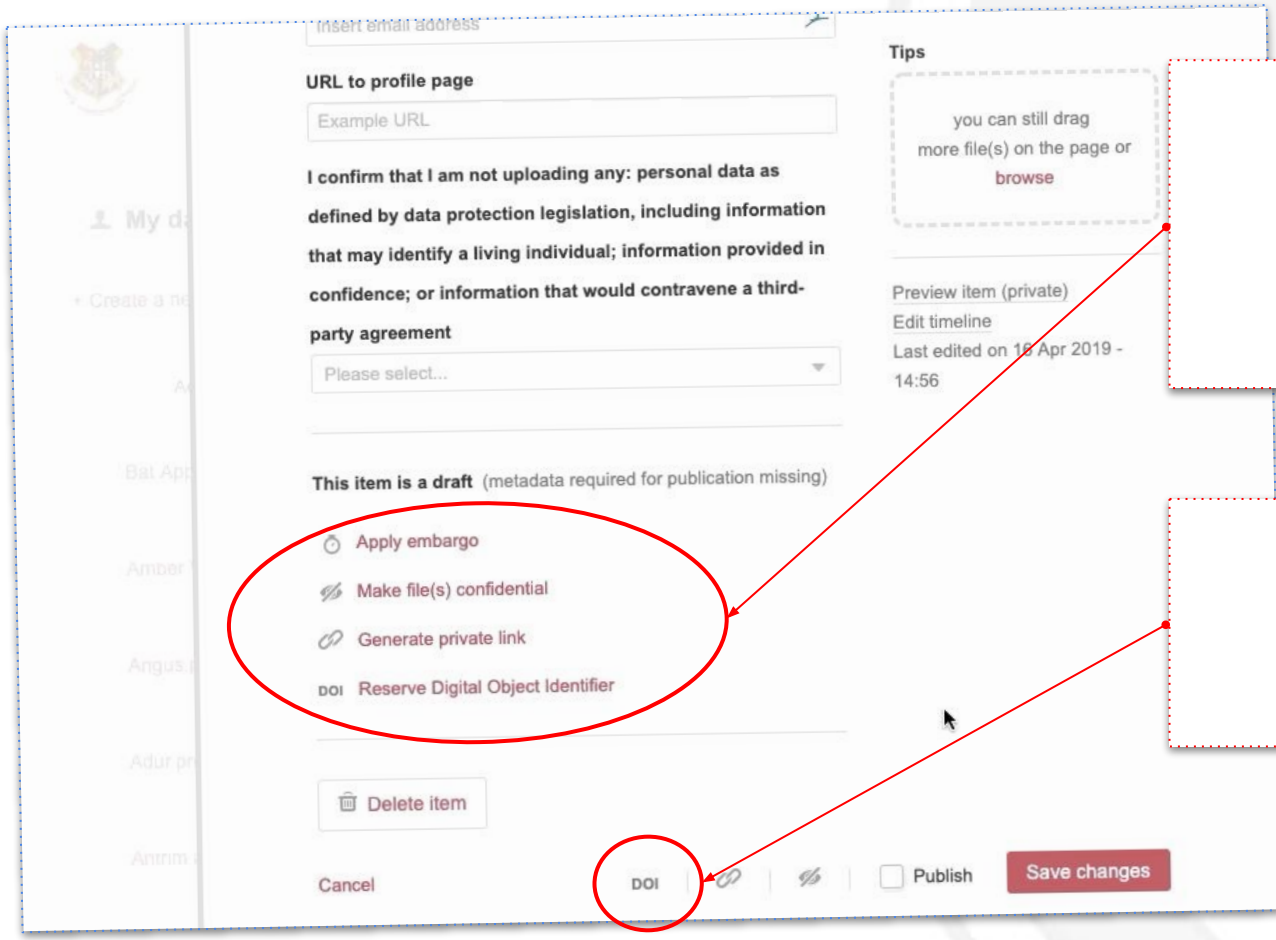
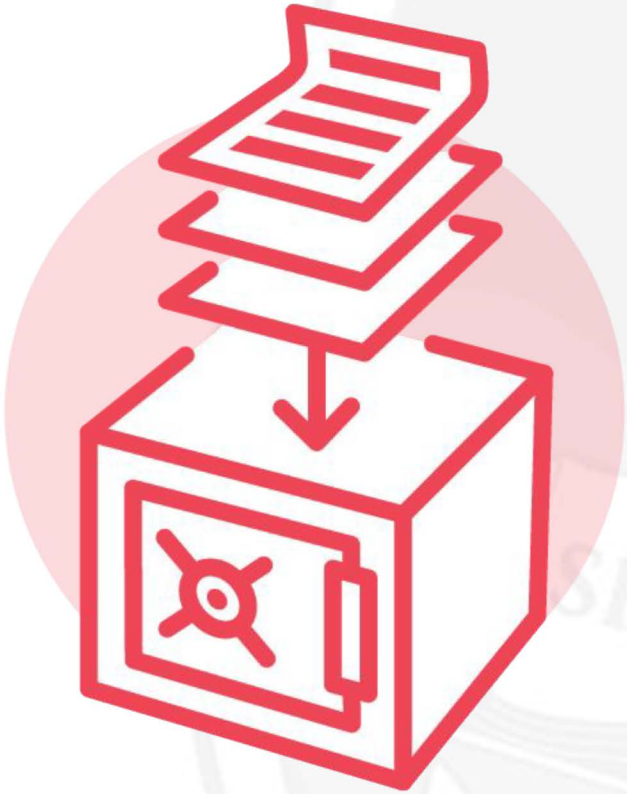
DIGITAL LIBRARY SERVICES



share data privately with your funders, reviewers, or supervisors before publishing it later

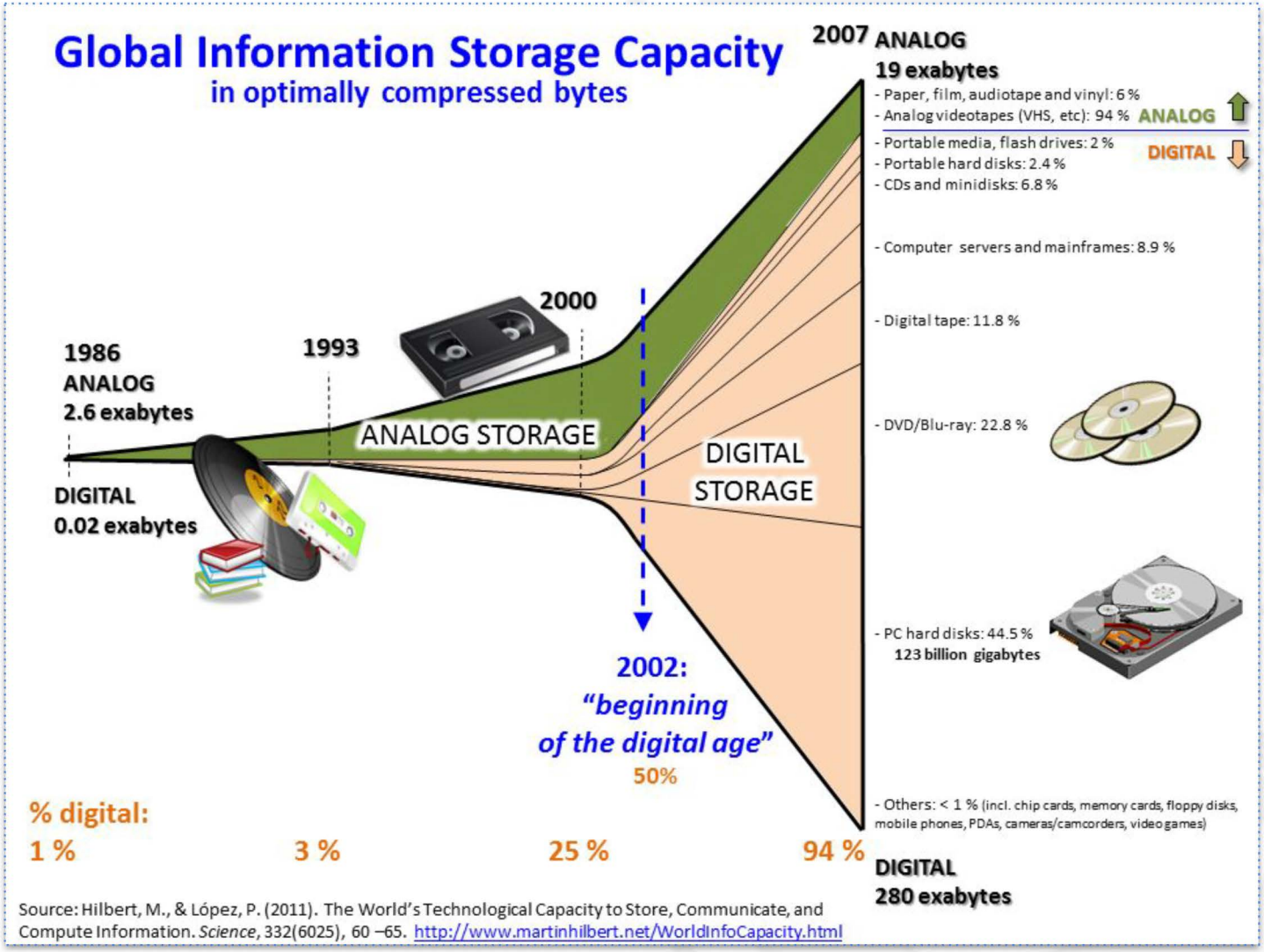
all item records get assigned a **Digital Object Identifier** (DOI)

Source: Figshare. **End User Guide GIFs**. Available: https://figshare.com/s/b3600c85f576d88d067b



MANAGE, STORE, PRESERVE

A brief history of the 'data deluge'



Source: Hilbert, M., & López, P. (2011). The World's Technological Capacity to Store, Communicate, and Compute Information. *Science*, 332(6025), 60 –65. http://www.martinhilbert.net/WorldInfoCapacity.html

Storage & Backup ≠ **Preservation**

Yes, maintaining **backups** of your stored data is crucial! But this does **not mean** that they are **digitally preserved**. Digital preservation is an institutional endeavour to ensure that data remain accessible and usable **in the long term**, in view of:

- **technological change** (e.g. legacy media & formats)
- **bit-rot** (decay of digital files over time, e.g. on flash drives)
- **link-rot** (decay of identifiers over time, e.g. on websites)
- **media failure** (e.g. 'head crash' on hard drives, CD-Rs oxidising)

Digital preservation is generally handled by specialist staff, such as archivists and librarians, using dedicated hard- and software solutions. Researchers need to be aware that some of their data may legally require digital preservation, and ideally participate actively in the process of planning for it from the outset (see: DMP).

Example: **Digitisation** for digital preservation

‘legacy’ media →	hardware →	software →	digital files			→ !
			master (preservation)	service (working)	access (access)	
Documents: manuscripts; theses; ...	flatbed scanner; feeder scanner; …	Acrobat Pro; …	.tif	.jpg	.jpg .txt .pdf	
Images: photographic prints; positives (slides); negatives; maps; ...	virtual drum scanner; digital camera & lighting equipment; map scanner, ...	Silverfast Studio; Nextimage; Photoshop; Lightroom; ...	.tif .fff .dng	.jpg	.jpg .png	
Audio: ¼-inch reel-to-reel; cassette; DAT; MD; ...	reel-to-reel, cassette, DAT and MD recorders; DAC; mixer; ...	Logic Pro; Waves Restoration Suite plugins; MediaHuman Audio converter; ...	.aif	.wav	.mp3	
Video: Umatic; Betacam; VHS; MiniDV; ...	Umatic, Betacam and VHS cleaners and recorders; MiniDV, DVCam descks; …	MediaExpress; FinalCut Studio; Premiere Pro; …	.mov .mpg2	.avi	.mp4	

A future problem: **where is my data?**

I know where it is but…

- It's in an unsupported file format
- It's in a legacy system
- It's not well described so it's irretrievable
- It's corrupted

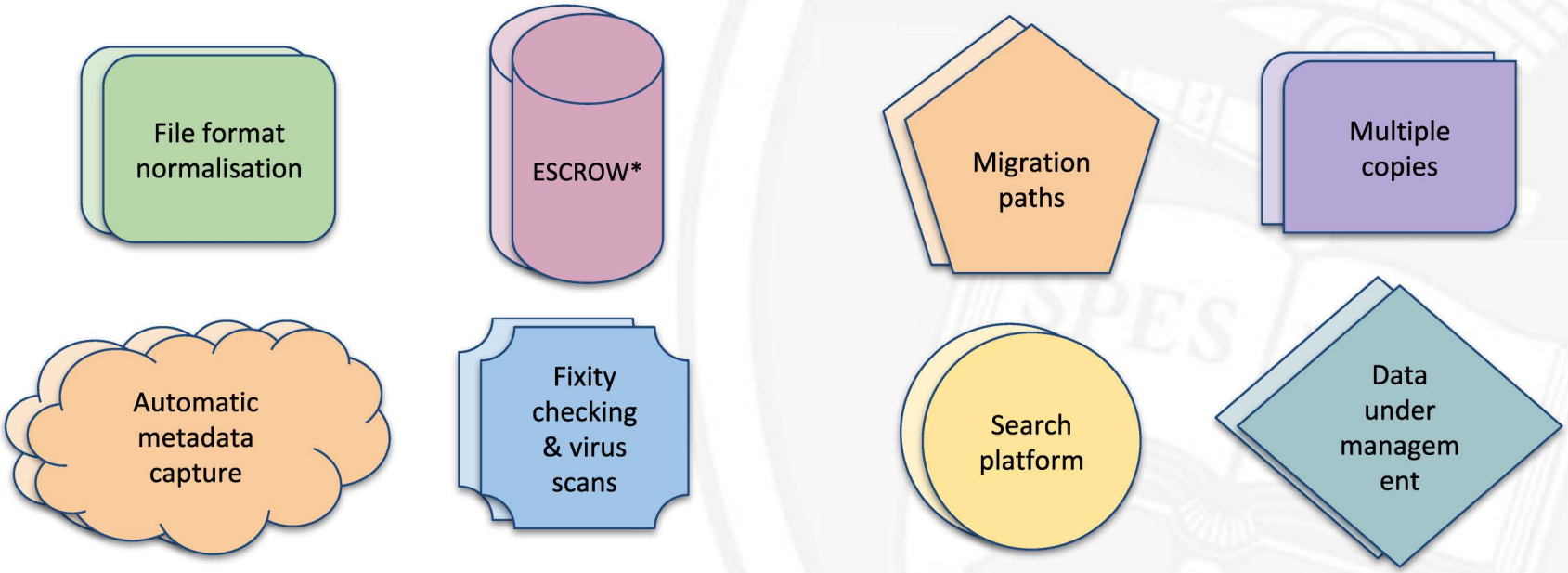
I don't even know where it is...

- It was on destroyed hardware
- A third party has it
- It's on a hard drive in a vault
- I expected it to be just where I left it

!

Adapted from: Arkivum: **Webinar Recording - Making the case for digital preservation.** Available: http://sites.arkivum.com/webinar-recording-making-the-case-for-digital-preservation-how-to-engage-your-internal-stakeholders-20-sept?hsCtaTracking=afd562aa-7fef-4f16-a1de-0958a8d68dce%7C277de3d6-6467-4c10-a387-8931548403fe

Digital preservation **technologies** & **processes**



** **'Source code escrow** is the deposit of the source code of software with a third-party escrow agent. Escrow is typically requested by a party licensing software (the licensee), to ensure maintenance of the software instead of abandonment or orphaning.' Online. Available: https://en.wikipedia.org/wiki/Source_code_escrow*

Adapted from: Arkivum: **Webinar Recording - Making the case for digital preservation.** Available: http://sites.arkivum.com/webinar-recording-making-the-case-for-digital-preservation-how-to-engage-your-internal-stakeholders-20-sept?hsCtaTracking=afd562aa-7fef-4f16-a1de-0958a8d68dce%7C277de3d6-6467-4c10-a387-8931548403fe

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Closing Remarks & Future Interactions

DS, RDM and OS

Digital Scholarship is the application and integration of digital tools and methods discover, research and teach.

Research Data Management is the organization and documentation of research data (ideally towards making it **F**indable, **A**ccessible, **I**nteroperable and **R**eusable).

Open Science is a set of *practices* that drives all aspects of research to be more efficient, accountable, collaborative, and of good quality.

Digital Scholarship, within a research project, integrates digital technologies, works within networked environments and subscribes to Open Science. When all the above intersect, DS has the power to transform the research landscape.

Upcoming Workshops

Research Data Management:
Plan for your Data with DMPonline
12 June @ 10 AM

‘RDM at UCT’ Slack workspace

Slack: ‘*Searchable Log of All Conversation and Knowledge*’

[RDM at UCT (Slack)]

[UCT DMPonline]

[OneDrive / Google Drive etc.]

[UCT Open Science Framework (OSF)]

[Digital preservation]

[ZivaHub | Open Data UCT]

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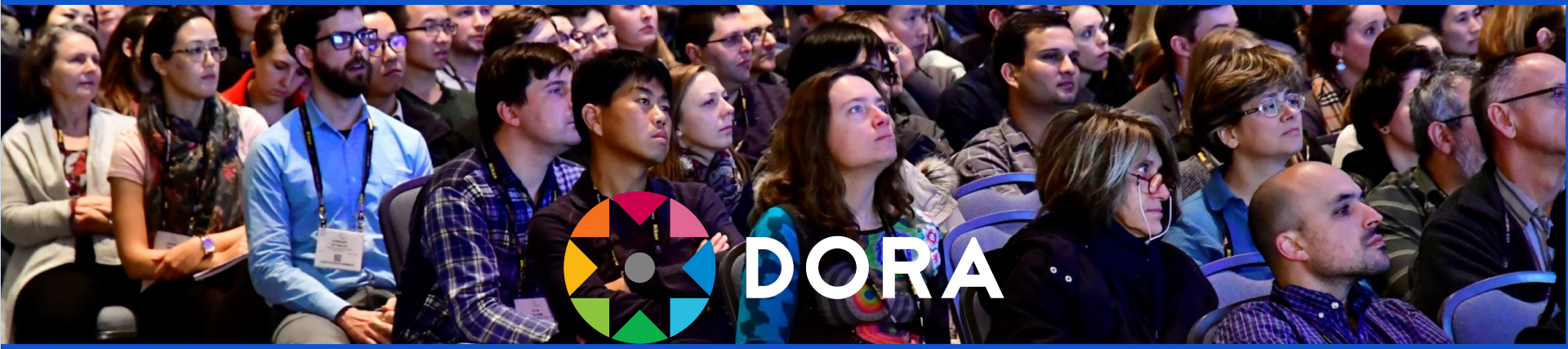

Declaration On Research Assessment

Improving how research is assessed

sfdora.org

@DORAssessment

now also including UCT!

Signed by >500 organizations and >12,500 individuals

Supporting organizations

ascb an international forum for cell biology · CANCER RESEARCH UK · eLIFE · EMBO excellence in life sciences · F1000Research Open for Science · Hindawi · PLOS · The Company of Biologists · wellcome

Thank you!

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