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Research Data Management

Data Lifecycle, Stakeholder Roles, and Competencies

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Contents of the Presentation

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Questions and Comments

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- Please take note of the link or scan the QR code with your phone.

https://padlet.com/rantasaari/rdm-321uhu5ix5rjs6y3

Scan the code using the Padlet app on your phone or tablet.

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What is Data?

- All the information systematically acquired and processed into new knowledge in an academic research (Pryor, 2012).
- Anything that you “perform analysis upon” (Briney, 2015, p. 6)
- Means to validate research results: “a product of research and an essential part of the evidence necessary to evaluate research results, and to reconstruct the events and processes leading to those results” (Research Information Network, 2008).
- E.g: Sources in archives or in libraries; notes in your laboratory note book; variables and their values in excel sheets; statistics; interview transcriptions; PET scanning data; etc.

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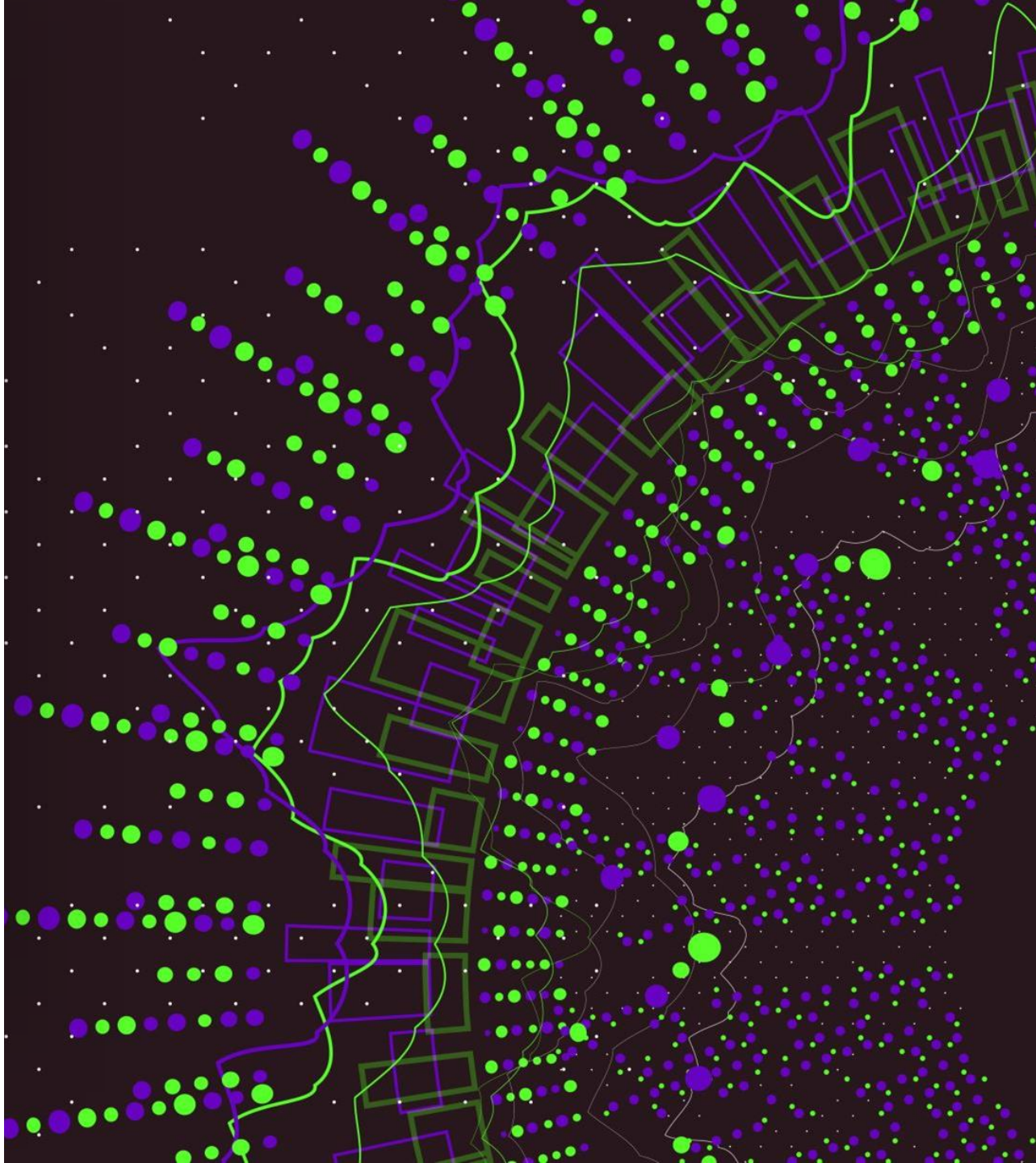
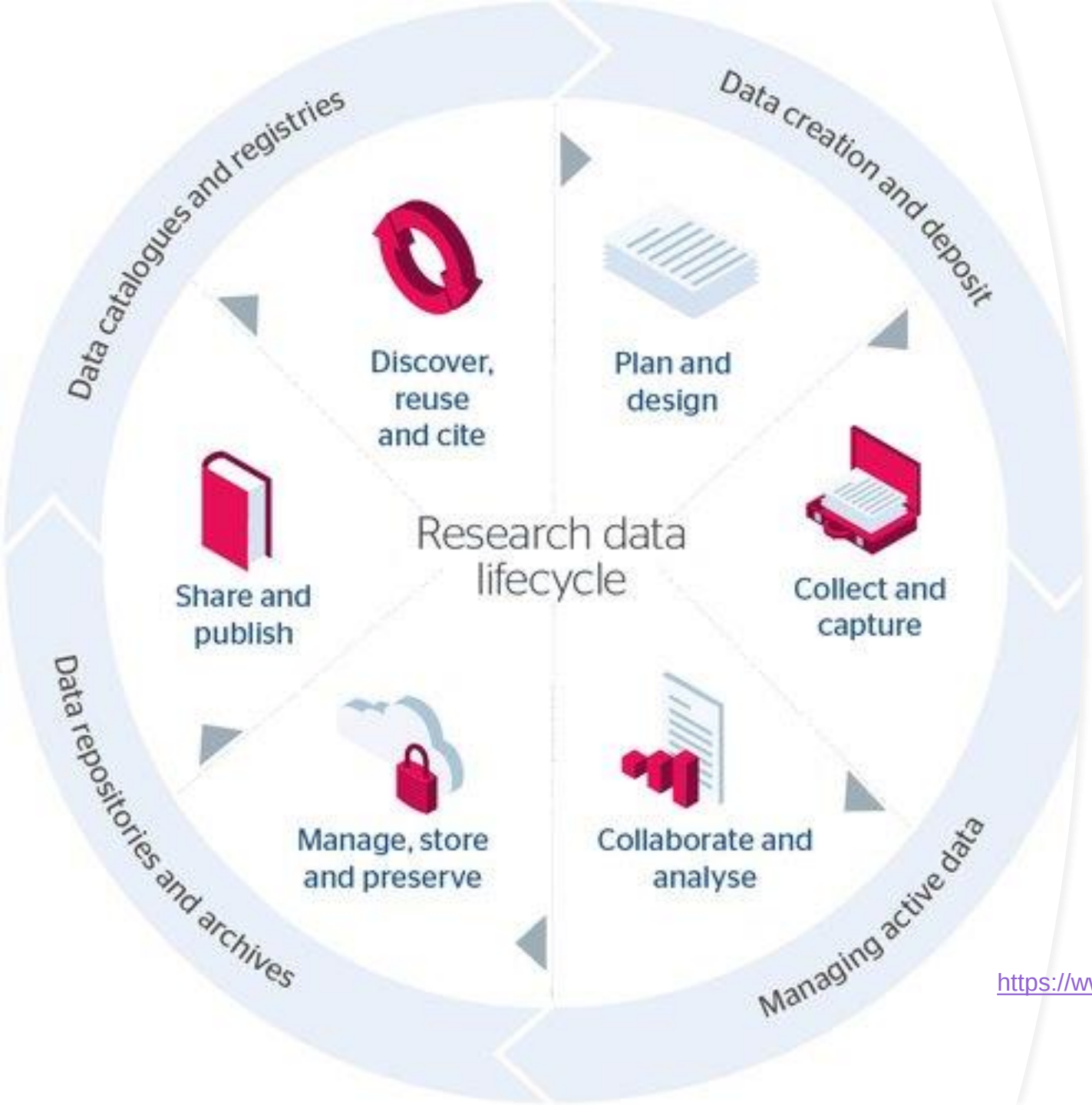
What is Research Data Management (RDM)?

- Keeping data well-organised and documented, so that it is easy to share with other researchers and the public.
- RDM is systematic treatment of data, involving operations to get easier to find, understand and use data in the present and future projects (Briney, 2015, p. 7).
- Involves data related procedures during the whole lifecycle of research data including planning and executing data gathering, legal and ethical considerations, processing, documenting, analyzing, visualizing, organizing, storing, preserving, and sharing.





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Research Data Lifecycle

- Data creation and deposit
  - Plan and design
- Managing active data
  - Collect and capture
  - Collaborate and analyse
- Data repositories and archives
  - Manage, store and preserve
- Data catalogues and registries
  - Share and publish
  - Discover, reuse and cite

https://www.jisc.ac.uk/guides/research-data-management-toolkit

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Plan and Design

Data Management Planning (DMP)

- Create a formal DMP to enhance research efficiency, protection, verifiability, exposure, and compliance with funding policies.
- Utilize tools like DMPOnline, DMPTool, Research Data Management Organiser or Data Stewardship Wizard for planning.

Policy Compliance

- Adhere to both funder and institutional policies, especially regarding the availability of research results and data.

FAIR Principles

- Ensure data is Findable, Accessible, Interoperable, and Reusable to maximize impact and enable new research collaborations.

Costing

- Accurately estimate the costs for data-related activities, considering both full lifecycle costs and those specific to RDM.

Accessibility Considerations

- Recognize that while data should be as open as possible, restrictions may apply due to privacy, security, or commercial concerns; clarify access conditions.

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Stakeholders' responsibilities

Researcher

- Develops a data management plan.
- Considers ethical aspects of data.
- Chooses tools for FAIR compliance.

Data Librarian/Steward

- Consults on data management plans.
- Assists with FAIR principles.
- Clarifies legal considerations and budgeting.

ICT Specialist

- Suggests data storage solutions.
- Advises on data accessibility.
- Assesses tech needs for data management.

Data Scientist/Analyst

- Ensures alignment with data analysis.
- Sets metadata standards.
- Recommends data integrity checks.

NB: Researchers need not engage all stakeholders throughout the data lifecycle but should be aware of available support services and individuals for assistance when necessary.

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Phase	Stakeholder	Role in Phase
Plan and design Data Management Planning (DMP) Policy Compliance FAIR Principles Costing Accessibility Considerations	Researcher	•Develops an initial data management plan, aligning research objectives with data requirements. •Identifies data types and potential data sources, outlines ethical considerations for data collection and use. •Determines the tools and software needed for the project's data management tasks. •Establishes the groundwork for FAIR principles adherence in future research phases
	Data Librarian / Steward	•Advises on the creation of a data management plan, ensuring it complies with institutional and funder policies. •Provides guidance on implementing FAIR principles and suggests appropriate tools and repositories for data sharing. •Assists in identifying potential legal and ethical issues related to data collection and sharing. •Supports researchers in understanding the costs associated with data management and helps identify potential funding for these activities.
	ICT Specialist	•Recommends suitable data storage solutions and backup systems, considering the project's scale and security needs. •Advises on technical aspects to ensure data is findable and accessible, including metadata standards and persistent identifiers. •Assesses software and hardware requirements for data collection, processing, and analysis
	Data Scientist / Analyst	•Collaborates in the planning stage to ensure the proposed data collection methods are aligned with the intended data analysis techniques. •Helps define metadata standards from an analytical perspective to ensure data will be usable and interoperable for future analyses. •Suggests data validation and quality assurance processes to maintain the integrity of data throughout the project's lifespan.

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Collect and Capture

Active Data Storage and Backup

- Utilize robust storage and backup systems, with a minimum of two media types, to protect against data loss.

Protection of Personal Data

- Minimize the creation of personal data copies and ensure the security and proper destruction of this information post-project.

Metadata Documentation

- Create detailed metadata at both study and data levels to facilitate discoverability, context, reuse, and citation of data.

File Management and Formats

- Establish clear file naming conventions and hierarchical folder structures for easy location and management of data.

Format Compatibility

- Choose file formats that ensure long-term accessibility and usability, and consult resources like, e.g., the University of Edinburgh for guidance on format sustainability.

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Stakeholders' responsibilities

Researcher

- Gathers data as planned.
- Documents data and processes.
- Uses proper collection technologies.
- Organizes data clearly.

ICT Specialist

- Implements secure data storage.
- Advises on sensitive data security.
- Supports efficient data handling.

Data Librarian/Steward

- Helps develop metadata strategies.
- Advises on data cataloging and ethics.
- Emphasizes file management and formats.

Data Scientist/Analyst

- Aligns data collection with analysis.
- Establishes data storage structures.
- Develops validation and metadata protocols.

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Phase	Stakeholder	Role in Phase
Collect and capture Active Data Storage and Backup Protection of Personal Data Metadata Documentation File Management and Formats Format Compatibility	Researcher	•Collects the data according to the methodologies outlined in the data management plan. •Begins documenting the research process and data characteristics in accordance with metadata standards. •Ensures the proper use of data collection tools and technologies. •Manages the initial organization of data, applying naming conventions and maintaining a clear folder structure.
	Data Librarian / Steward	•Assists researchers in developing and refining metadata strategies for the collected data. •Provides advice on data cataloging, including the use of controlled vocabularies and best practices for metadata. •Offers guidance on legal and ethical aspects of data collection, especially relating to personally identifiable information. •Supports researchers in understanding the importance of file management and the implications of different file formats for long-term preservation and access.
	ICT Specialist	•Implements secure and reliable data storage and backup solutions tailored to the project's needs. •Advises on best practices for data security, especially when dealing with sensitive or confidential information. •Ensures the IT infrastructure can handle the data types and volumes being collected, offering solutions for data transfer and storage efficiency.
	Data Scientist / Analyst	•Works with the researcher to ensure that the data collection methods are aligned with the planned analysis methods. •Assists in setting up databases and data storage structures that facilitate efficient analysis. •Contributes to the development of protocols for data validation and quality assurance, to ensure the reliability of data for analysis. •May help in automating the capture of metadata during the data collection process to streamline subsequent data analysis.

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Collaborate and Analyse

Collaborative Research

- Establish documented data management processes and a data resources library. Assign clear roles, particularly for dataset oversight.

Data Sharing Tools

- Utilize shared spaces and tools like Dropbox, Google Drive, or – when handling personal or sensitive data - institution-provided cloud services for active file sharing.

Cloud and Offline Storage

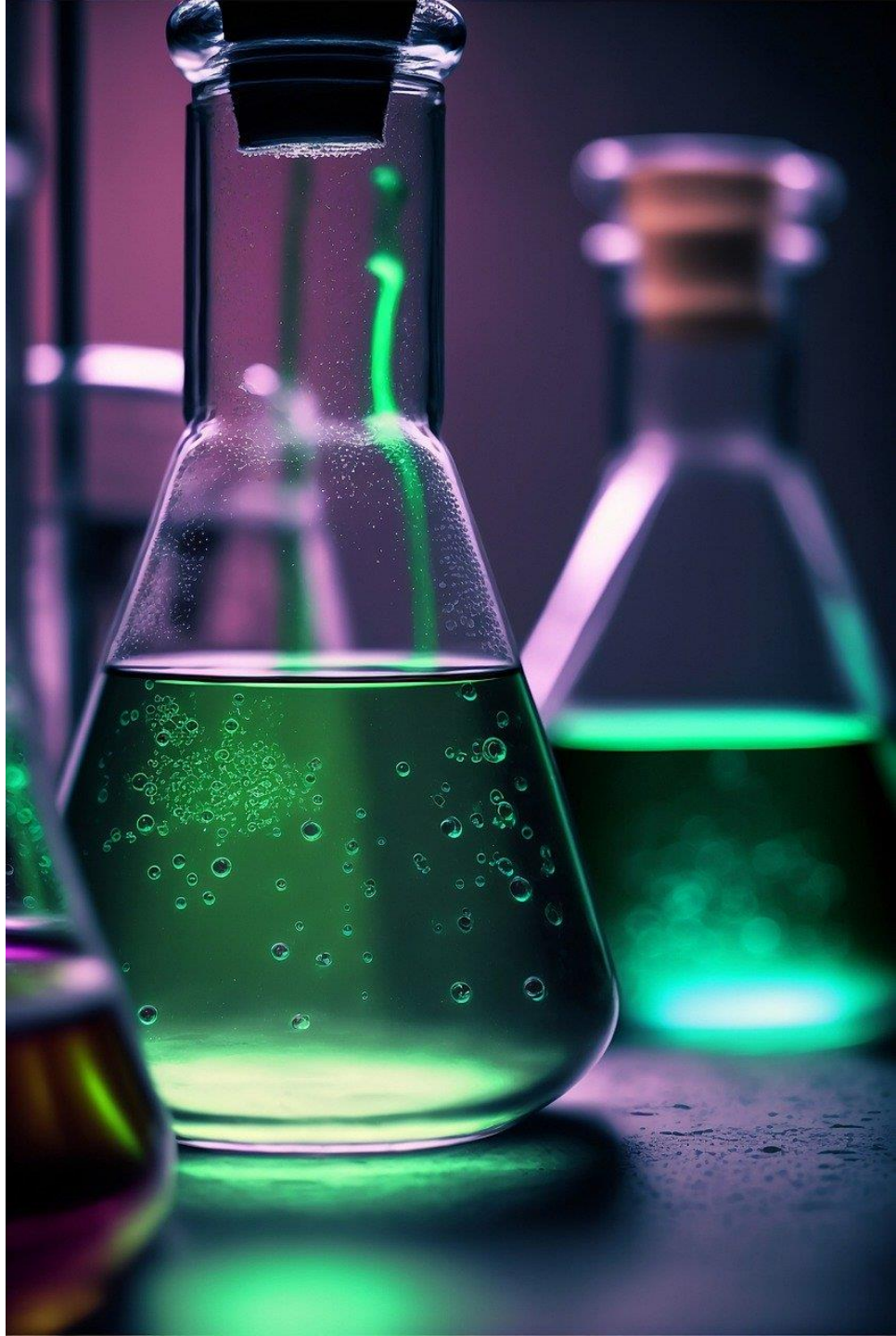
- Differentiate between everyday online cloud storage for collaboration and secure offline media for backups, mindful of international data transfer regulations.

Data Visualisation

- Use visualisations for impactful communication of findings; consider professional design assistance for public dissemination, while simpler tools may suffice for exploratory analysis.

Version Control and Documentation

- Implement consistent versioning practices for files in collaboration, ensuring all changes are well-documented and understood by the team.



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Stakeholders' responsibilities

Researcher

- Engages in team data sharing and analysis.
- Manages sensitive data ethically.
- Utilizes collaborative tools for communication.

ICT Specialist

- Provides secure storage and collaborative tools.
- Manages access controls and platform configurations.
- Implements data security measures.

Data Librarian/Steward

- Structures and documents collaborative research.
- Advises on secure data practices.
- Ensures data privacy and accessibility.

Data Scientist/Analyst

- Leads data analysis with statistical methods.
- Aligns analysis with research objectives.
- Creates visualisations and ensures reproducibility.

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Phase	Stakeholder	Role in Phase
Collaborate and analyse Data Sharing Tools Cloud and Offline Storage Data Visualisation Version Control and Documentation	Researcher	•Engages in collaborative research, sharing data with team members, and integrating data analysis results. •Contributes to defining and documenting the analysis methods and data management processes. •Utilizes collaborative tools for data sharing and communication with team members. •Is responsible for ensuring that all data, especially sensitive data, is handled in compliance with ethical standards during collaboration and analysis.
	Data Librarian / Steward	•Supports the organization and documentation of collaborative research processes and data management strategies. •Advises on best practices for sharing and storing data securely, especially in multi-institutional research teams. •Helps maintain the data resources library, ensuring that data is well-cataloged and accessible to all team members. •Guides the research team on data privacy, intellectual property rights, and ethical considerations.
	ICT Specialist	•Provides and maintains secure data storage solutions and collaborative tools for the research team. •Sets up and manages access controls for data repositories and shared spaces, ensuring secure collaboration. •Is responsible for the technical setup of collaborative platforms, considering different regulatory requirements across jurisdictions. •Ensures data security throughout the collaboration and analysis processes, providing encrypted solutions where necessary.
	Data Scientist / Analyst	•Leads the data analysis, employing statistical and computational methods to interpret the research data. •Collaborates closely with the research team to ensure that the data analysis methods are in line with the research objectives. •Is involved in the creation and refinement of data visualizations that effectively convey research findings. •Ensures that data analysis procedures are reproducible and transparent for future validation and reuse.

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Manage, Store and Preserve

Continuity and Impact

- Revisit and update data management, storage, and preservation plans as the project evolves, ensuring all steps reflect current needs and decisions.

Preservation Strategy

- Preserve data to ensure long-term usability and access; not merely storage but active management of data formats and software/hardware for future use.

Data Security

- Implement rigorous security protocols, including access controls and encryption, to protect data integrity and comply with legal obligations for personal data safety.

Data Protection Compliance

- Adhere to data protection laws, ensuring ethical research practices and informed consent, while considering the ongoing responsibility to protect personal information.

Software Management

- Acknowledge software as a critical aspect of research output; preserve essential code with thorough documentation and responsible sharing practices.

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Stakeholders' responsibilities

Researcher

- Aligns data management with methodology.
- Oversees data preservation for future use.
- Ensures data security and documents changes.
- Selects essential data/software for lasting impact.

Data Librarian/Steward

- Advises on preservation and management plans.
- Guides through data protection and compliance.
- Assists with data anonymisation.
- Consults on sustainable software management.

ICT Specialist

- Implements secure data storage solutions.
- Manages backup systems and integrates software.
- Ensures standard compliance and secure data sharing.

Data Scientist/Analyst

- Influences data management for analysis readiness.
- Ensures storage facilitates future analysis.
- Documents analytical workflows.
- Manages software for clear, ongoing use.

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Phase	Stakeholder	Role in Phase
Manage, store and preserve Continuity and Impact Preservation Strategy Data Security Data Protection Compliance Software Management	Researcher	•Ensures ongoing data management aligns with the research design and methodology. •Engages with data preservation to safeguard the content and context for future reuse. •Maintains data security, keeping it accessible to authorized individuals only. •Manages and documents changes in data throughout the project lifecycle. •Decides what data and software are crucial to preserve for the longevity of the research impact.
	Data Librarian / Steward	•Provides guidance on best practices for long-term data preservation and access. •Assists researchers in creating comprehensive data management and preservation plans. •Helps navigate data protection regulations and compliance with funding mandates. •Supports the identification and anonymization of personally identifiable information within datasets. •Advises on software management to ensure the longevity and reproducibility of research tools.
	ICT Specialist	•Implements secure data storage solutions and manages infrastructure for both active and archival data. •Oversees data backup processes, ensuring redundancy and protection against loss or corruption. •Facilitates the integration of research software into data management systems. •Ensures that data is stored in compliance with technical and legal standards. •Provides tools and platforms for securely sharing sensitive information.
	Data Scientist / Analyst	•Contributes to establishing data management processes that consider analytical requirements. •Ensures that data is stored in a way that facilitates future analysis and reuse. •Works on preserving analytical workflows and documenting data transformations and analyses. •May assist in the anonymization process, ensuring data can be used while preserving confidentiality. •Involves in managing analytical software, making sure it remains operable and understandable for future use.

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Share and Publish

Promoting Discoverability and Citation

- Share research data through various formal and informal means, making it discoverable and citable; ensure data is well-documented, correctly formatted, and accompanied by a suitable license.

Understanding Intellectual Property

- Acknowledge intellectual property and copyright when creating data; select appropriate licenses to enable reuse while considering employer's rights and collaborative work.

Choosing the Right License

- Prefer standard licenses like Creative Commons for ease of use and wider reusability; tools like GitHub's License Selector can assist in making an informed choice.

Using Identifiers Effectively

- Utilize Persistent Identifiers (PIDs) such as DOIs to maintain long-term citability and traceability of research data; consider services like ORCID to link research outputs to your professional identity.

Strategic Data Linking to Publications

- Obtain DOIs by depositing data in repositories and include data access statements in publications; use re3data and FAIRsharing to find suitable repositories, enhancing data's impact and reach.

Stakeholders' responsibilities

Researcher

- Prepares and selects data for sharing.
- Chooses licenses for data use.
- Publishes data with complete metadata.

Data Librarian/Steward

- Guides on intellectual property and licensing.
- Helps choose the appropriate data repository.
- Assists in creating standard-compliant metadata.

ICT Specialist

- Provides infrastructure for secure data sharing.
- Manages DOIs and identifiers.
- Tracks data usage and citations.

Data Scientist/Analyst

- Finalises data for sharing with quality checks.
- Recommends formats for data reuse.
- Analyses data impact and usage.

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Phase	Stakeholder	Role in Phase
Share and publish Promoting Discoverability and Citation Understanding Intellectual Property Choosing the Right License Using Identifiers Effectively Strategic Data Linking to Publications	Researcher	•Decides which data to share, ensuring it is tidy, well-documented, and correctly formatted for sharing. •Chooses the right license to govern the conditions under which the data is shared. •Publishes data in relevant repositories or alongside academic articles, with the appropriate metadata and access statements.
	Data Librarian / Steward	•Advises on intellectual property issues, copyright, and the selection of suitable licenses for data sharing. •Supports the researcher in choosing the appropriate repository for data deposition. •Assists with the creation of metadata, ensuring it adheres to community standards and enhances discoverability.
	ICT Specialist	•Provides and maintains the infrastructure for secure data sharing and publishing. •Helps set up DOI issuance for datasets and ensures persistent identifiers are applied. •Implements systems for tracking usage and citations of shared data.
	Data scientist / Data analyst	•Prepares data for sharing, often performing final analyses to ensure data quality and completeness. •May provide specialized insight into which data formats and structures are best for sharing and reuse. •Can help interpret data usage metrics to assess the impact and reach of shared data.

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Discover, Reuse and Cite

Exploration and Reuse

- Utilise repositories to discover data for potential reuse, ensuring adherence to good RDM practices for accessibility, documentation, and identifiability.

Ethical Reuse and Citation

- Respect the terms, conditions, and intellectual property of data; cite sources properly when reusing data and share any new data under the original license.

Acknowledging Contributions

- Data citation, akin to bibliographic citation, acknowledges researchers' contributions, enhances transparency, and can lead to increased academic recognition.

Impact and Recognition

- Deposit data with clear metadata in trusted repositories to facilitate citation and impact assessment; include equipment and software citations to support reproducibility.

Metrics for Data Impact

- Employ metrics like altmetrics and traditional citation counts to evaluate the impact of shared data, recognizing the field's ongoing evolution and the role of these practices in promoting research transparency.

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Stakeholders' responsibilities

Researcher

- Finds and reuses datasets from repositories.
- Follows data terms and conditions.
- Cites datasets as per academic norms.

ICT Specialist

- Keeps repositories indexed and searchable.
- Manages citation tracking systems.
- Provides citation management tools.

Data Librarian/Steward

- Helps locate repositories and interpret metadata.
- Ensures proper citation with identifiers.
- Clarifies licensing and reuse terms.

Data Scientist/Analyst

- Assesses datasets for reuse.
- Applies statistical analysis for robustness.
- Documents reuse rationale for reproducibility.

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Phase	Stakeholder	Role in Phase
Discover, reuse and cite Exploration and Reuse Ethical Reuse and Citation Acknowledging Contributions Impact and Recognition Metrics for Data Impact	Researcher	•Uses repositories to discover datasets for potential reuse in their own research. •Adheres to the terms and conditions attached to the data they wish to reuse. •Appropriately cites the datasets they use in accordance with academic standards.
	Data Librarian / Steward	•Assists researchers in locating data repositories and understanding the metadata for discovered datasets. •Provides guidance on the proper citation of datasets and the use of persistent identifiers like DOIs. •Helps researchers navigate the terms of use and licensing of datasets for reuse.
	ICT Specialist	•Ensures that institutional repositories are well-indexed and searchable to facilitate the discovery of datasets. •Maintains systems that support the citation tracking and metrics evaluation of datasets. •Provides technical solutions for managing citations in research outputs.
	Data scientist / Data analyst	•Analyses reused datasets to confirm their validity and relevance to new research questions. •Applies statistical methods to ensure the robustness of analyses when integrating reused data. •Documents the process and rationale behind the reuse of datasets to support reproducibility.

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Competences of the Key Stakeholders

Researchers, Data Librarians, Data Stewards, ICT Specialists, Data Scientists, and Data Analysts

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Researchers

- Designing and conducting studies, hence they need to plan for data management from the outset.
- Understanding data collection methods and the importance of quality.
- Applying ethical considerations and compliance with regulations in their data practices.
- Documenting the research process and preparing data for sharing and publication.
- Analysing data and interpreting results.

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Data Librarians

- Information Management:
  - Expertise in organizing, cataloging, and archiving datasets. Knowledge of metadata standards and practices to enhance data discoverability.
- Reference Services:
  - Ability to assist researchers in finding relevant data and resources. Skilled in using databases and search tools.
- Instructional Skills:
  - Providing training on data literacy, including how to manage, share, and preserve data. Able to develop educational materials and workshops.
- Technical Skills:
  - Familiarity with repository software and data curation tools. Some understanding of programming or scripting may be beneficial for automating tasks.
- Communication and Advocacy:
  - Ability to articulate the value of good data management practices. Advocating for data sharing and open access within the research community.

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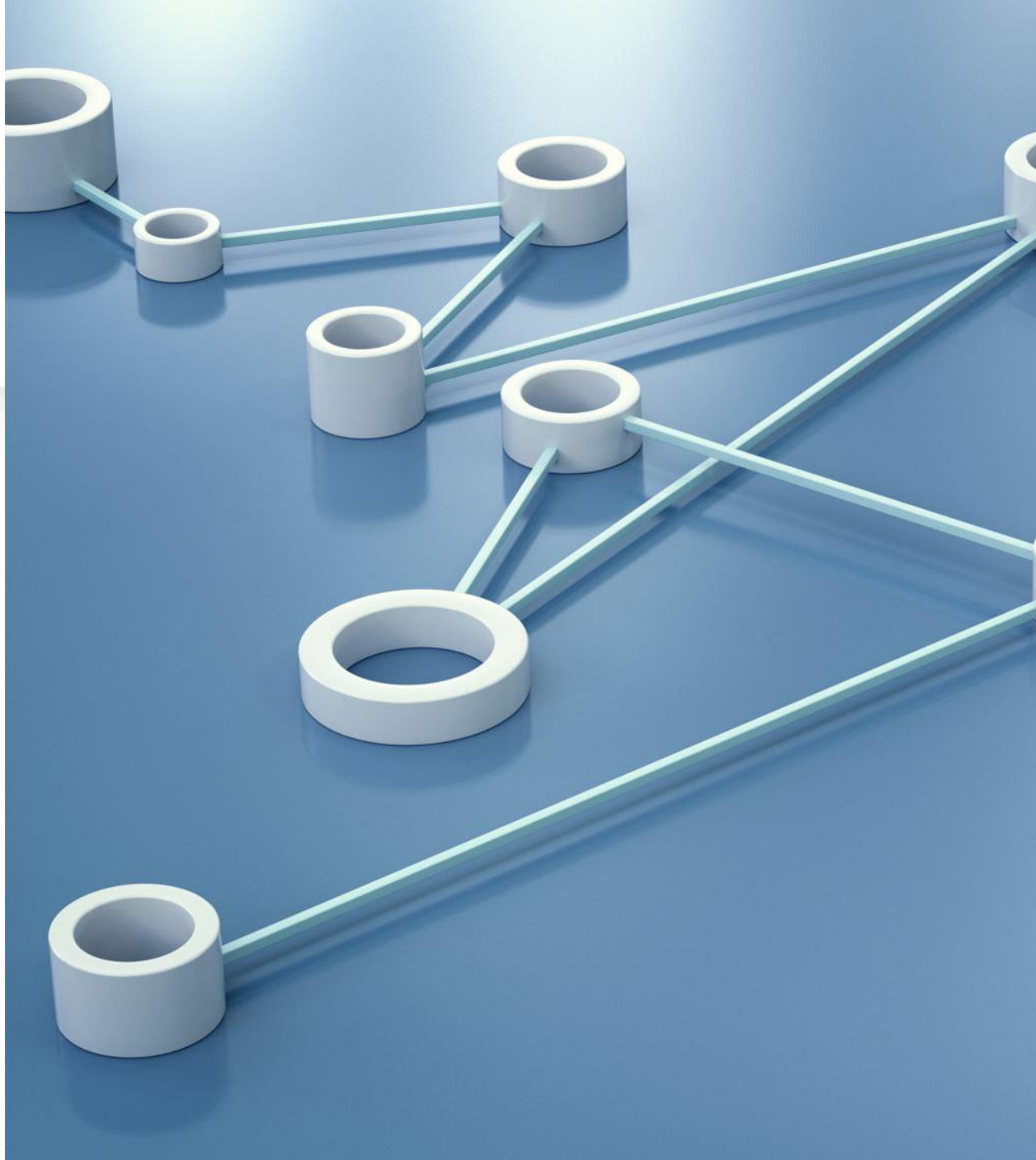
Data Stewards

- Data Governance:
  - Understanding of data governance principles and practices. Ability to develop and implement data policies and standards.
- Project Management:
  - Skills in managing data-related projects, including setting goals, coordinating teams, and ensuring project deliverables meet data quality standards.
- Data Quality Management:
  - Ensuring the accuracy, consistency, and reliability of datasets. Implementing processes for data cleaning and validation.
- Stakeholder Engagement:
  - Collaborating with researchers, IT staff, and management to align data management strategies with organizational goals. Effective at negotiating and consensus-building.
- Technical Expertise:
  - Knowledge of data storage solutions, data security measures, and legal aspects of data handling. Proficiency in data architecture and modeling may also be required for complex projects.



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ICT Specialists

- Providing the necessary technical infrastructure for data storage and management.
- Ensuring data security and implementing backup systems.
- Facilitating the integration of different data systems and platforms for smooth data flow.
- Developing and maintaining hardware and software solutions for data-related tasks.
- Keeping abreast of technology trends to upgrade and advise on data management tools.

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Data Scientists

- Specializing in statistical analysis, data mining, and predictive modeling.
- Developing algorithms and computational models to process and analyse large datasets.
- Applying machine learning techniques to interpret complex data structures.
- Translating data insights into actionable recommendations.
- Ensuring the integrity and reliability of data analysis.

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Data Analysts

- Primarily focusing on processing and performing statistical analysis on existing datasets.
- Interpreting data, analysing results using statistical techniques, and providing ongoing reports.
- Identifying, analysing, and interpreting trends or patterns in complex data sets.
- Working closely with management to prioritize business and information needs.
- Utilising strong analytical skills to provide support in decision-making processes.

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Data Librarian / Steward Vs. Legal Counsel and Data Protection Officer

From initial guidance to expert advice

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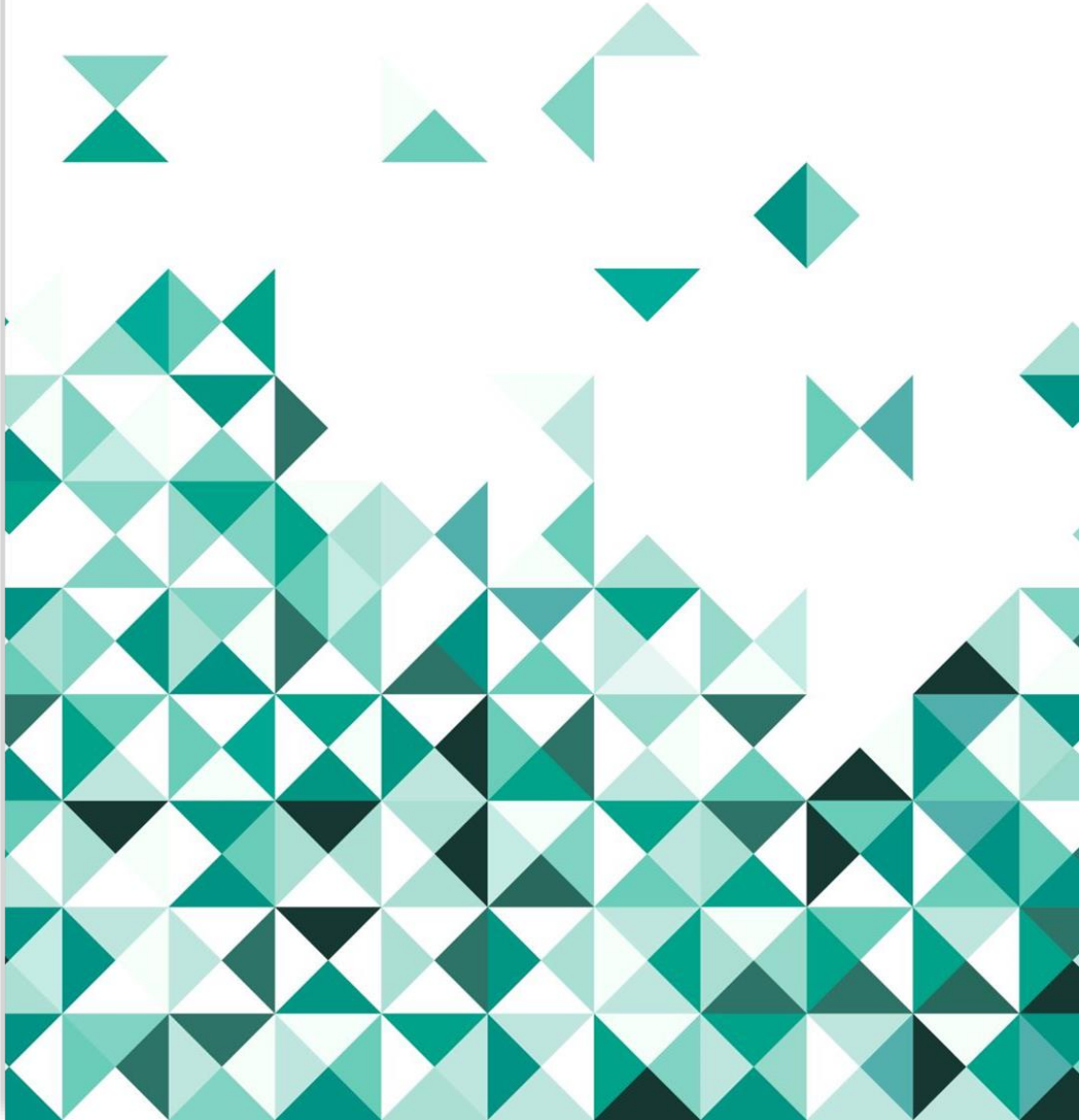
Data Librarian / Steward

- Offers initial guidance on standard practices and general principles in intellectual property rights, copyright, licensing, and data privacy.
- Helps researchers understand the typical requirements and conditions of data sharing and reuse, including the selection of suitable licenses.
- Assists in navigating the institution’s policies and funders’ requirements regarding data management.
- Provides educational resources and directs researchers to appropriate tools for managing their data legally and ethically.



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Legal Counsel

- Provides expert advice on complex legal issues, interpreting laws, and regulations that affect the research data, which may include international laws if the research spans multiple countries.
- Helps draft and review contracts, agreements, and other legal documents related to the research, such as data sharing agreements or terms of use for data repositories.
- Advises on liability, risk, and strategies for protecting intellectual property and compliance with relevant legislation, like copyright laws and patentability.

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Data Protection Officer (DPO)

- Focuses specifically on ensuring that the processing of personal data complies with data protection laws such as the GDPR.
- Conducts data protection impact assessments for research projects that handle sensitive or personally identifiable information.
- Advises on the implementation of data protection principles and the rights of data subjects.
- Acts as a point of contact for data subjects and regulatory authorities, handling queries and investigations related to data protection.

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Data Librarian Vs. Data Steward

The organization, accessibility, and dissemination of data Vs. governing the lifecycle of data across an organization

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Data Librarian

- Traditionally focuses on the organization, preservation, and dissemination of information.
- Provides assistance in finding existing datasets and scholarly information.
- Educates and assists users in data search strategies and the use of databases.
- Supports metadata creation and data cataloging to enhance data discoverability.
- May assist in managing institutional repositories or data archives.

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Data Steward

- Often takes a broader role in the governance of data, ensuring quality, accessibility, and usability across the organization.
- Develops and implements data management policies and procedures in line with organizational and regulatory requirements.
- Oversees the lifecycle of data, from creation and storage to archiving and disposal.
- Works closely with researchers to ensure data is FAIR (Findable, Accessible, Interoperable, and Reusable).
- Engages in the development of data infrastructure that supports data sharing and collaboration.

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Thank you!

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