

# Making the Future Possible (Sustainability of NRENs)

**Role of NRENs in Supporting R&E Communities in Engagement with Open Science**

Yerevan, Armenia, 3 October 2023

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**Education and Professional Experience**

**Masters in Library and Information Science**

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- EOSC FAIR Champion – FAIR IMPACT Project
- Danish National Forum for European Open Science Cloud
- EOSC Association FAIR Metric and Data Quality Task Force
- CODATA GOSC Technology Infrastructure Working Group
- CODATA GOSC Data Interoperability Working Group
- European Open Science Cloud (EOSC) Nordic

**Research Data Alliance (RDA) Group Memberships such as:**

- Data Repository Attributes Working Group
- Repository Platforms for Research Data Information Group
- Research Metadata Schemas Working Group

...



# Agenda

Engagement – Open Science for NREN

Eight Pillars of Open Science

NREN Supporting Open Science

Support Mechanisms and Collaborations

Conclusion

Q&A – Open Discussions

CAN I ATTEND  
THIS SEMINAR?

SORRY, WE HAVE A  
NEW POLICY

— YOU FIRST  
NEED TO  
DONATE SOME  
OPEN DATA

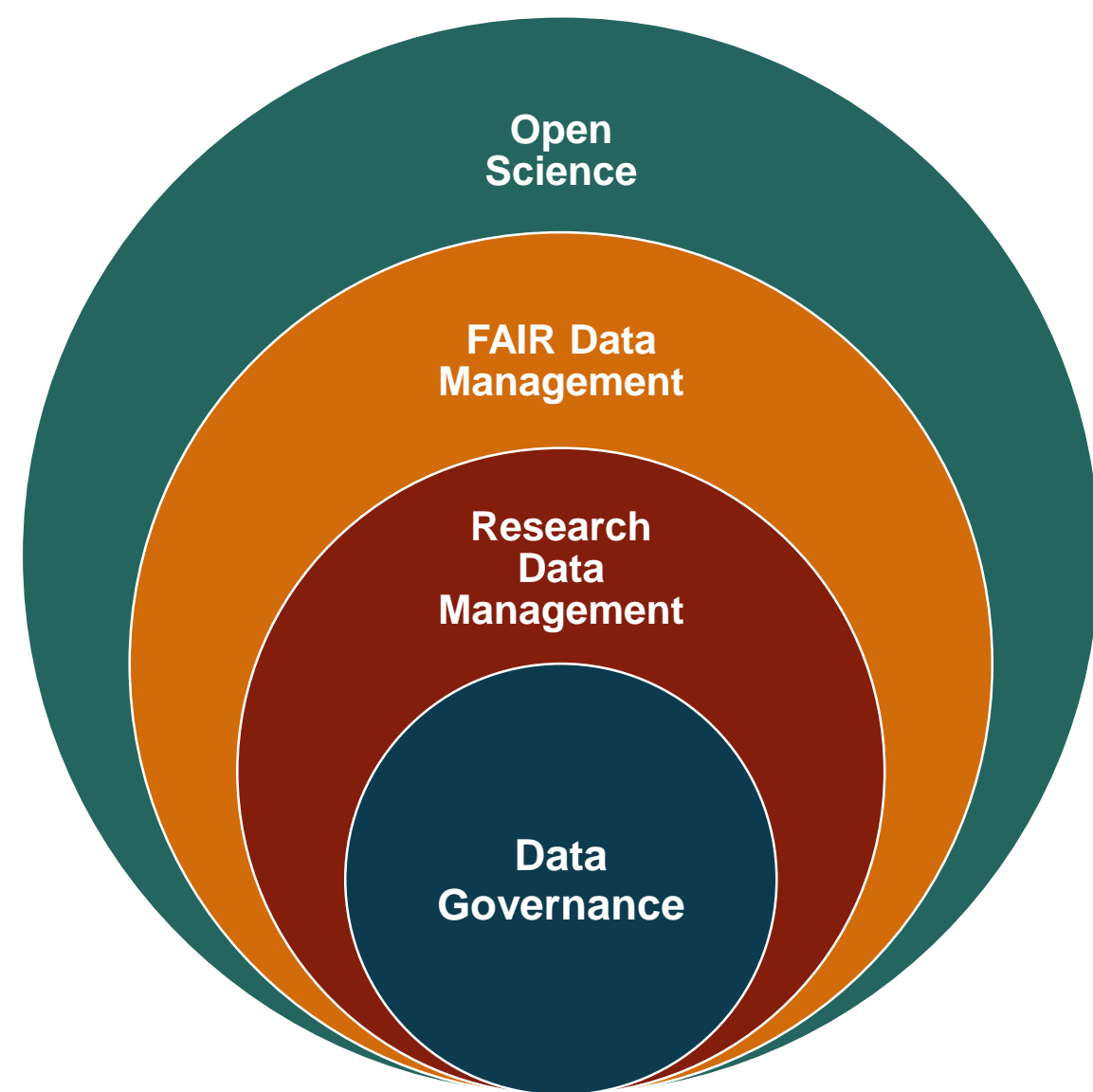


# Four Core Elements of Open Research Data Management Framework



# Open Research Data Management Framework (ORDMF)

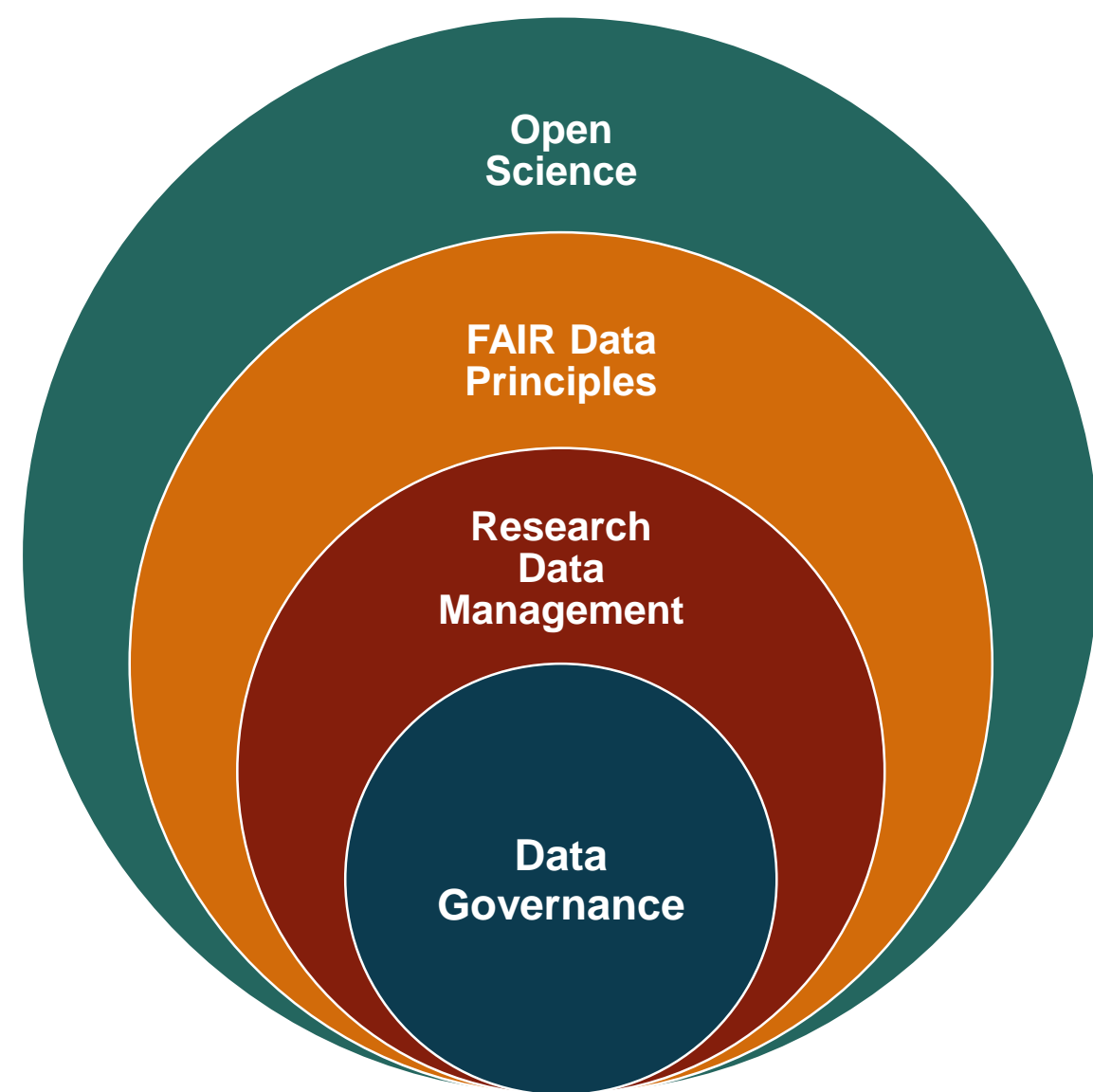
- Innovative Framework
- Alignment with Open Science
- Embrace of FAIR Principles
- Promotion of Data Usability
- Rigorous Data Governance
- Compliance with Ethical and Legal Norms



Open Research Data Framework: by Richard Dennis - NNF Center for Stem Cell Medicine - Data Champion Program. Licensed under a [Creative Commons Attribution-Non-Commercial 4.0 International License](#).

Integrating these key features and principles, the **ORDMF provides a comprehensive, ethical, and robust open research data management strategy.**

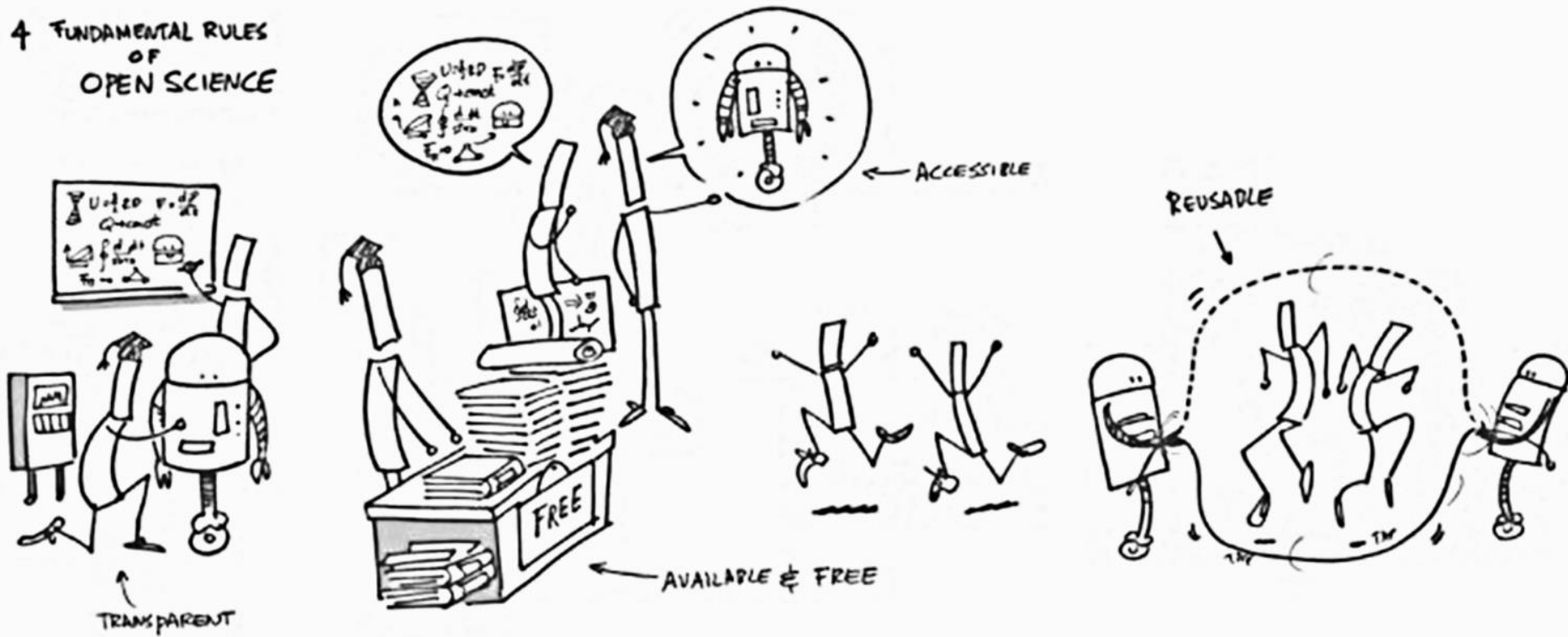
Each bullet point underscores a distinct framework aspect, offering a holistic view of its capabilities and standards.



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# Open Science

## 4 FUNDAMENTAL RULES OF OPEN SCIENCE



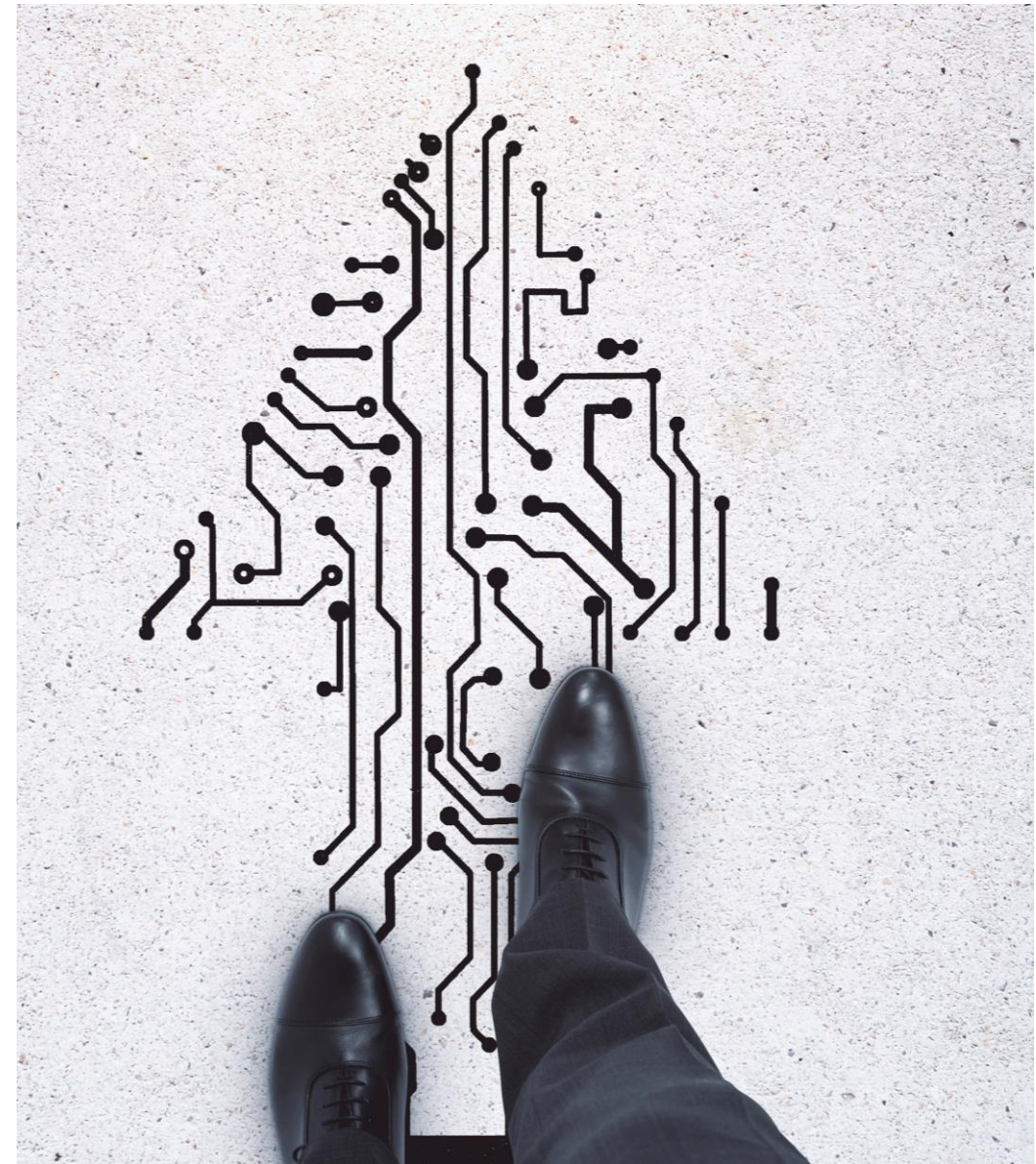


# Open Science is... cultural change.

**Open Science** refers to making scientific research, data, and dissemination **accessible to all levels of society**.

**Four key bullet points** to encapsulate the concept:

- **Transparency in Methodology and Data**
- **Public Access to Research Outputs**
- **Collaborative Research**
- **Promotion of Open Source and Open Standards**



# Based on LERU\*, Open Science is based on these Eight Pillars:



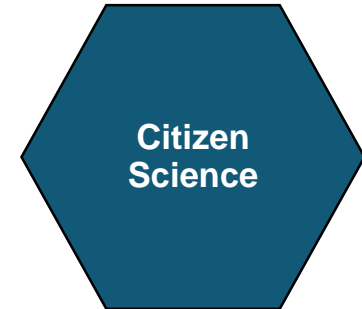
**FAIR stands for Findable, Accessible, Interoperable, and Reusable.** This pillar emphasizes the importance of effective data management to ensure that scientific data is easily discoverable, accessible for further study, integrated with other datasets, and reusable for future research.



**Open Access to Publications:** This pillar focuses on making scholarly publications accessible to all. It aims to move away from subscription-based models to those that allow unrestricted access to research outputs, often through open-access journals and repositories.



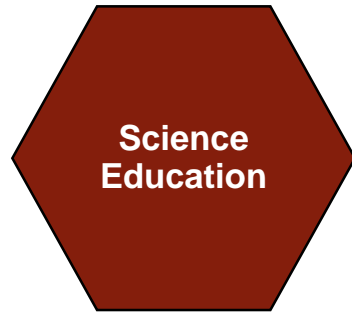
**Research Integrity:** Upholding ethical standards and transparent methods in research is central to this pillar. It aims to cultivate trust in scientific processes and outcomes by ensuring researchers adhere to the highest ethical norms and standards.



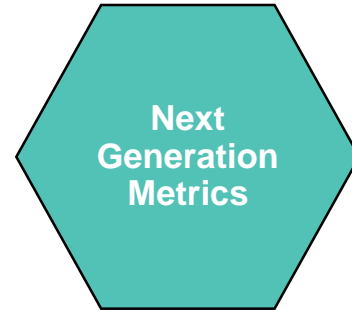
**Citizen Science:** This pillar encourages the active participation of the public in scientific research. Whether it's data collection, analysis, or dissemination, citizen science endeavors to make science a more collaborative and inclusive endeavor.

\* LERU - League of European Research Universities is a consortium of European Research Universities.

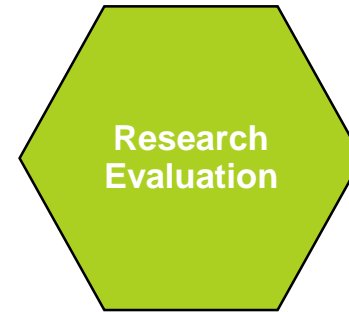
# Based on LERU\*, Open Science is based on these Eight Pillars:



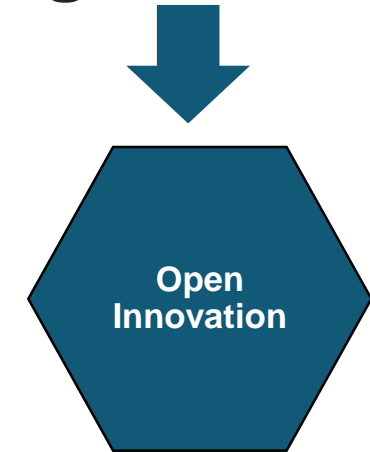
**Science Education:** Open Science in education focuses on using open educational resources (OER), curricula, and evaluation materials to facilitate the teaching and learning of science. The goal is to make quality science education accessible to a broader audience.



**Next-Generation Metrics:** Traditional metrics like citation counts are often considered insufficient in capturing the full impact and quality of research. This pillar advocates for developing and adopting new metrics that offer a more nuanced and comprehensive evaluation of scientific output.



**Research Evaluation:** This pillar calls for rethinking how research and researchers are evaluated. It questions the over-reliance on journal impact factors and promotes the inclusion of other assessment methods more aligned with Open Science principles.



**Open Innovation:** Fostering collaborative research not just within academia but also with industry and the public sector is the focus of this pillar. Open Innovation seeks to accelerate the application of research findings to real-world problems by promoting shared goals, resources, and outcomes.

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# FAIR Data Principles

## FAIR DATA PRINCIPLES



# FAIR Data Principles\*

The **FAIR Data Principles** are **guidelines** for making research data, code, digital objects, and documentation **Findable, Accessible, Interoperable, and Reusable**.

Drafted by researchers, funders, and publishers in 2016, described in the **Nature article**: “*The FAIR Guiding Principles for Scientific Data Management and Stewardship.*”

## Please note:

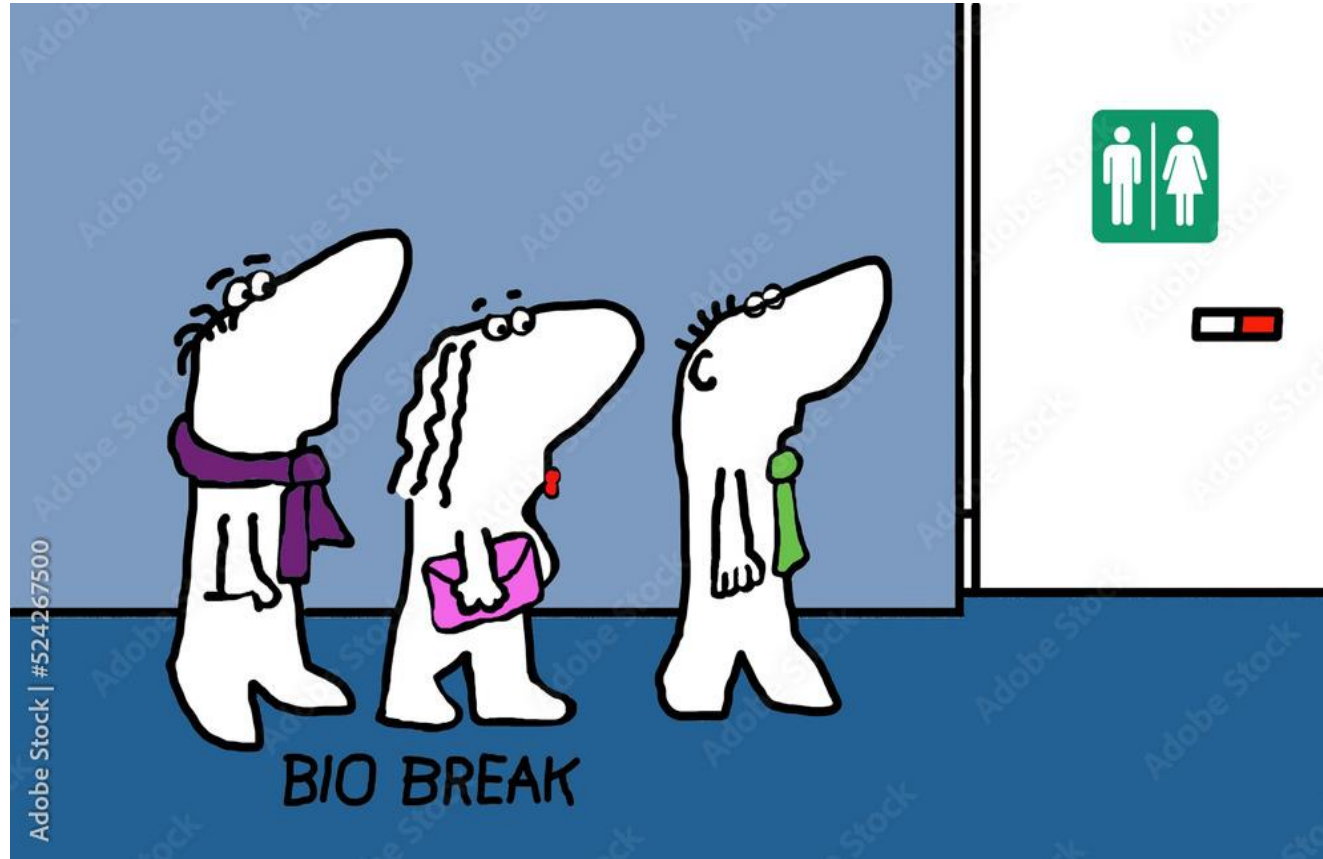
- **Open data = Open Access to data** = depositing data in a data repository from where they can freely be downloaded.
- **FAIR data ≠ Open data!**
- All open data must be FAIR, but not all FAIR data must be open.



The Magnifying glass, Tap, Gears set, Recycle sig, Storage, Infinity, Discussion, Shield, and Man User icons made by [Freepik](#) from [www.flaticon.com](#) are licensed by **CC 3.0 BY**. ARDC makes all other icons. The entire FAIR resources graphic is licensed under a **Creative Commons Attribution 4.0 International License**

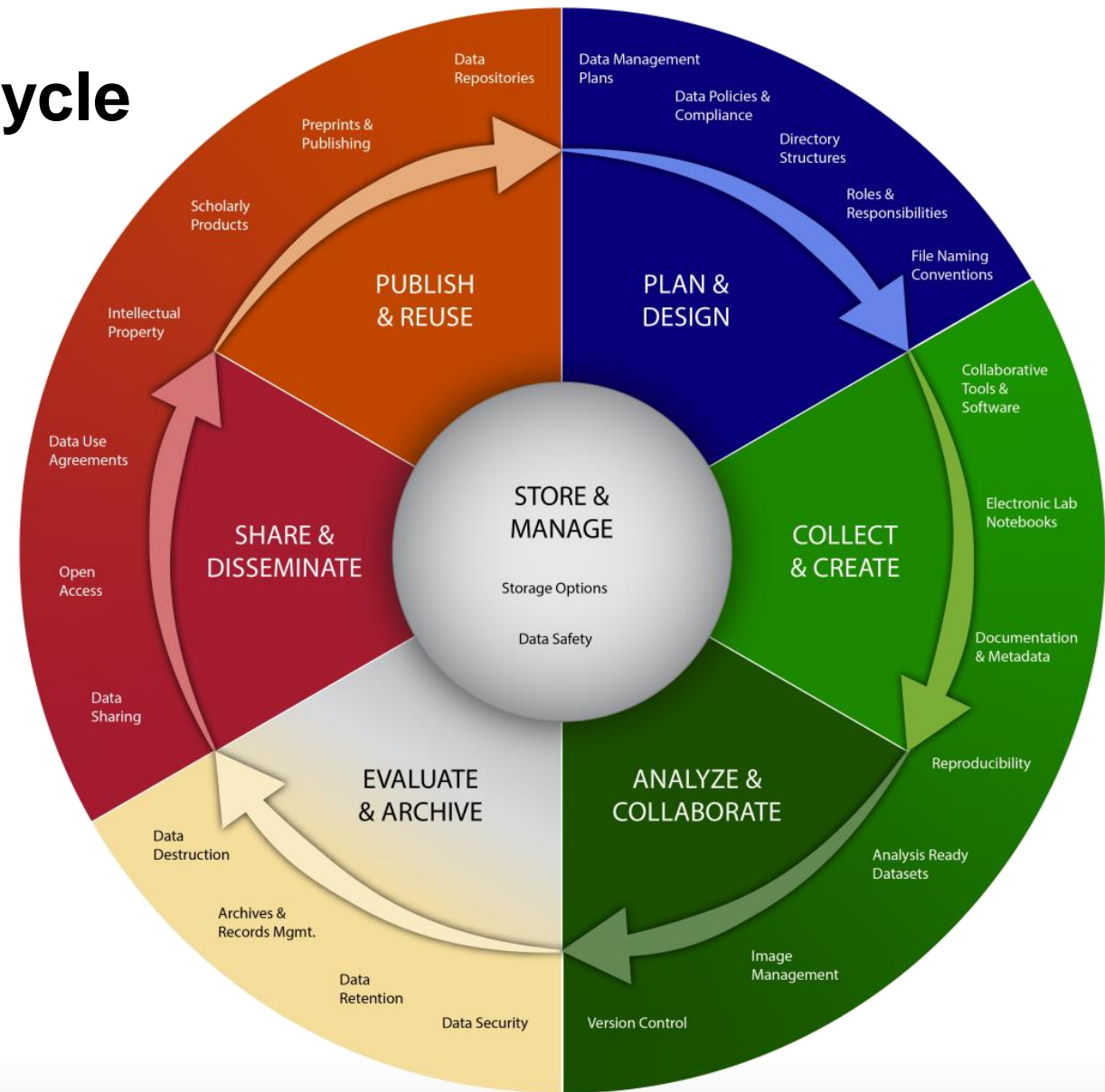
\*DOI: 10.1038/sdata.2016.18

Break



# Research Data Management Life Cycle

- **Research Data Management** involves the active organization and maintenance of data throughout the research process and suitable data archiving at the project's completion. It is an ongoing activity throughout the data lifecycle.
- The **Research Data Lifecycle** is a model that illustrates the stages of data management and describes how data flows through a research project from start to finish. It is an ongoing activity throughout the data lifecycle.



# Data Governance



## Data Governance

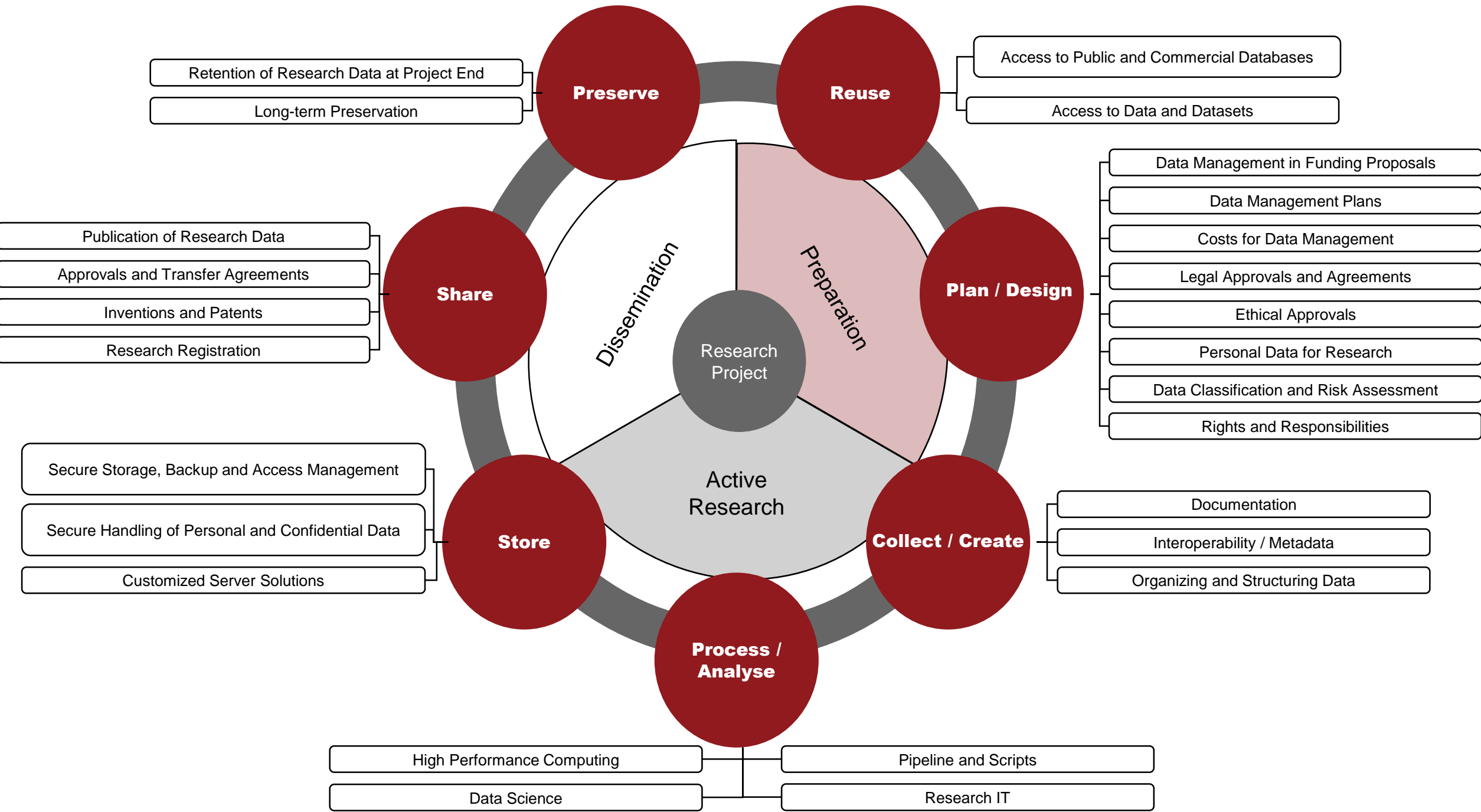
**Policy Framework:** Data Governance involves establishing and enforcing policies, procedures, and standards to manage and protect data assets throughout their lifecycle.

**Quality and Integrity:** It ensures that data is consistently defined and interconnected. This also involves validation processes to maintain data accuracy, completeness, and reliability.

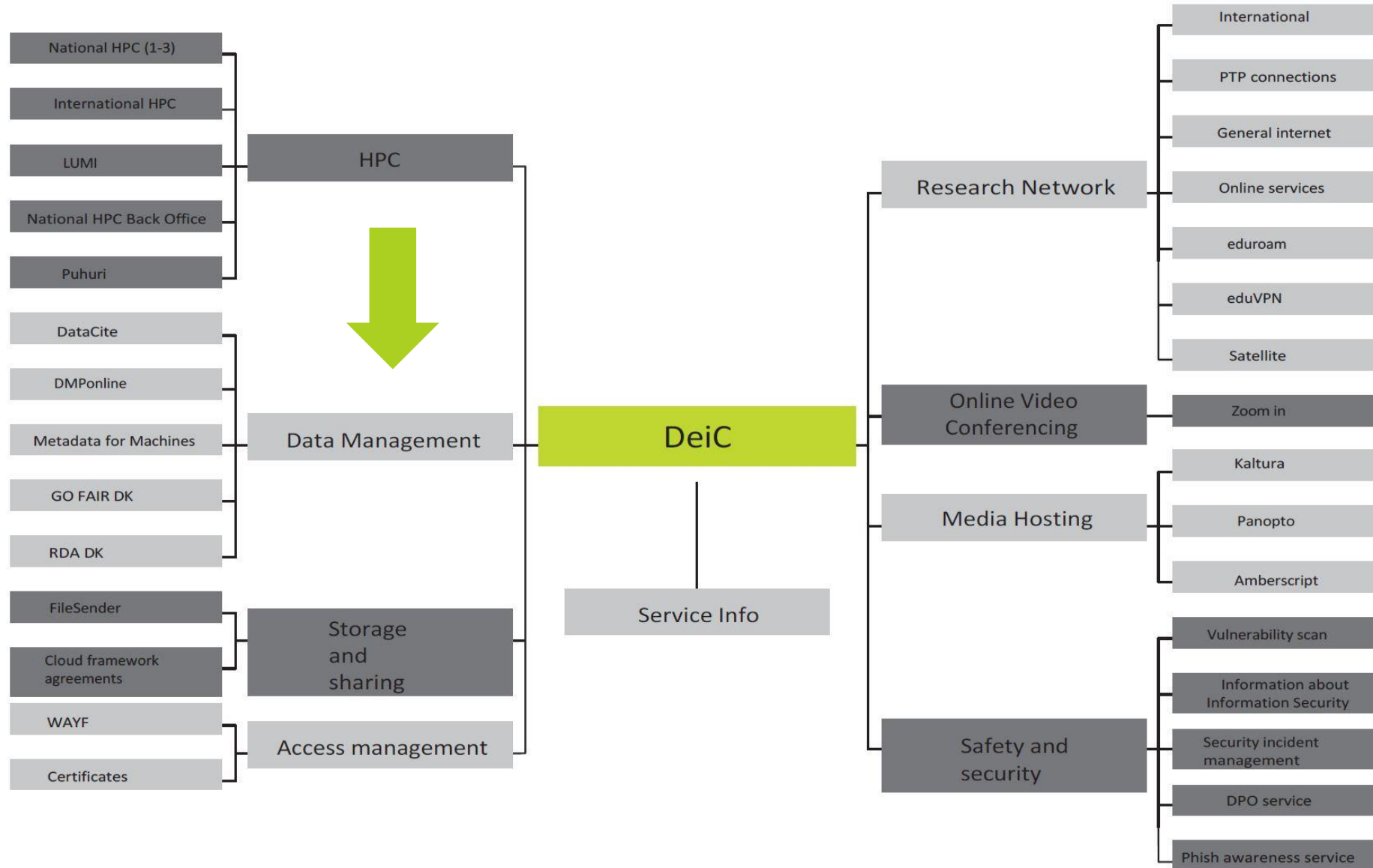
**Compliance and Security:** A core aspect of Data Governance is ensuring that data management practices comply with legal, ethical, and regulatory requirements while focusing on data security measures to protect against unauthorized access or alterations.

These points encapsulate the primary functions and objectives of Data Governance within Research Data Management.





# From Research Project to NREN in the Open Science Landscape: DeIC – Example



# How can NRENs support the R&E Communities?

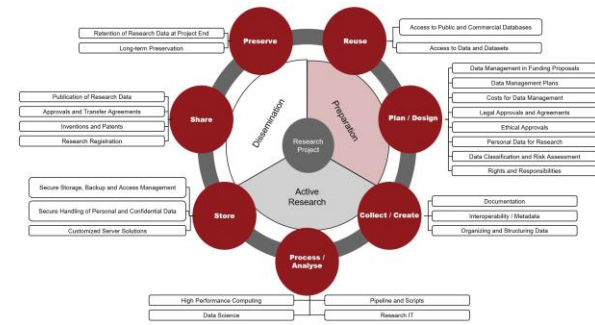
**Digital Infrastructure Development:** NRENs facilitate the robust digital backbone for Open Science activities. This includes high-speed data transfer, secure networks, and cloud services optimized for academic and scientific research.

**Data Management Services:** NRENs often provide or facilitate services for secure, efficient, and standardized data storage, sharing, and retrieval. This aligns with Open Science goals by ensuring that research data is accessible, reusable, and properly curated.

**Collaboration Tools and Platforms:** By offering advanced conferencing tools, collaborative software, and specialized platforms, NRENs enable seamless interdisciplinary and international collaboration, a cornerstone of Open Science.

**Policy and Advocacy:** NRENs may work with academic institutions, funding agencies, and governmental bodies to advocate for policies that promote Open Science. This includes the development of fair use policies, open-access mandates, and ethical guidelines for data sharing.

These four aspects outline how NRENs are uniquely positioned to engage with and significantly contribute to the Open Science movement.



# Q&A – Open Discussions

# Open Research Data Management Matrix for NRENs: Focused on Open Innovation

Refining an Open Research Data Management Matrix tailored for NRENs is crucial for fostering open innovation.

## Strategic Goals:

- **Accelerate Knowledge Transfer:** Enable seamless transfer of research findings into actionable insights that benefit academia, industry, and the public sectors
- **Facilitate Collaborative Research:** Encourage cross-disciplinary and multisectoral collaboration to tackle complex real-world problems.
- **Resource Optimization:** Ensure efficient allocation and sharing of resources like computational power, data storage, and expert talent.
- **Inclusive Growth:** Make research data and innovation processes accessible to diverse stakeholders, from students and faculty to industry experts and policymakers.

# Open Research Data Management Matrix for NRENs: Focused on Open Innovation

## Key Elements:

- 1. Shared Data Repositories:** Establish FAIR-compliant data repositories accessible to NREN members, researchers, and industrial partners.
- 2. Interoperability Standards:** Develop and promote common data formats and APIs to ensure that research data and findings are compatible across sectors and disciplines.
- 3. Ethical and Legal Frameworks:** Implement robust governance policies to address data privacy, intellectual property rights, and ethical considerations in research.
- 4. Advanced Tools:** Provide state-of-the-art data analytics and computational tools that multiple stakeholders can use collaboratively.

# Open Research Data Management Matrix for NRENs: Focused on Open Innovation

## Stakeholder Engagement:

1. **Academic Partnerships:** Engage universities and research institutes in ongoing dialogues to identify research needs and priorities.
2. **Industry Alliances:** Build strategic alliances with industry players to accelerate the commercialization of research findings.
3. **Public Sector Collaboration:** Work closely with governmental bodies to align research and innovation efforts with national objectives.
4. **Community Outreach:** Involve the general public and local communities in the research and innovation process through citizen science projects and open forums.

## Open Research Data Management Matrix for NRENs: Focused on Open Innovation

### Performance Metrics:

1. **Collaboration Index:** Measure the frequency and impact of cross-sectoral collaborations facilitated by the NREN infrastructure.
2. **Data Reusability Score:** Assess how often and effectively the shared data repositories are used for new research and innovation.
3. **Resource Utilization Rate:** Track the usage efficiency of computational and data storage resources allocated for open innovation.
4. **Innovation Impact Score:** Quantify the real-world impact of research findings, such as patents filed, products developed, or societal problems addressed.



Thank you for your attention

# Acknowledgments

Illustrations: Patrick Hochstenbach (University of Gent, Belgium)  
The Open Science Training Handbook <http://book.fosteropenscience.eu/en/>

Research Data Lifecycle by LMA Research Data Management Working Group is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License. Longwood Medical Area, Harvard Medical School

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# Backup

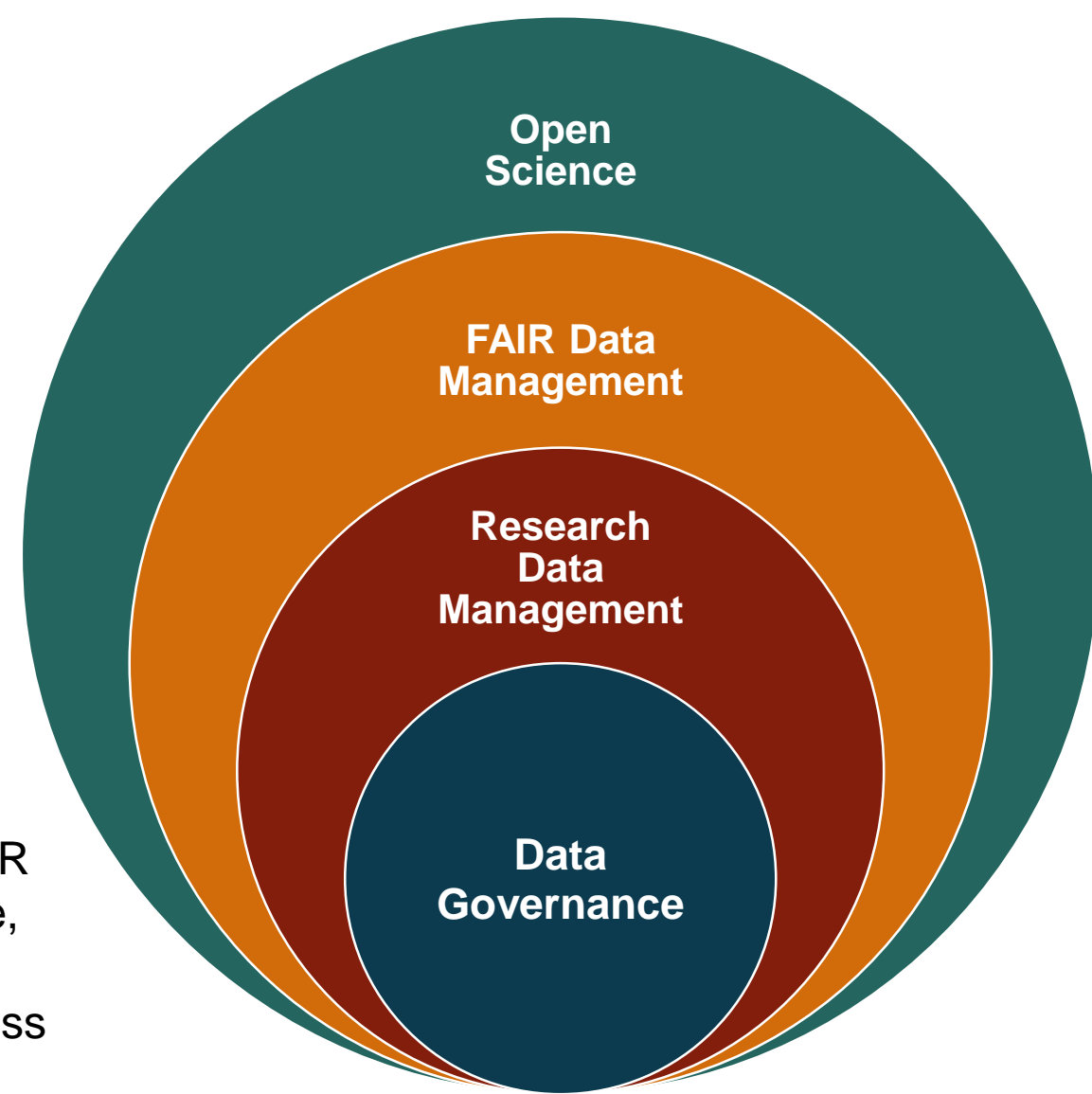


# Open Research Data Management Framework (ORDMF)

**Innovative Framework:** The ORDMF is an innovative structure explicitly engineered to tackle the intricate challenges of managing open research data.

**Alignment with Open Science:** Seamlessly aligned with the Open Science movement, the framework advocates for transparency, collaboration, and broad dissemination in scientific research.

**Embrace of FAIR Principles:** ORDMF incorporates the FAIR Data Management, ensuring that research data are Findable, Accessible, Interoperable, and Reusable. This alignment enables access and the effective use and reuse of data across diverse scientific communities.

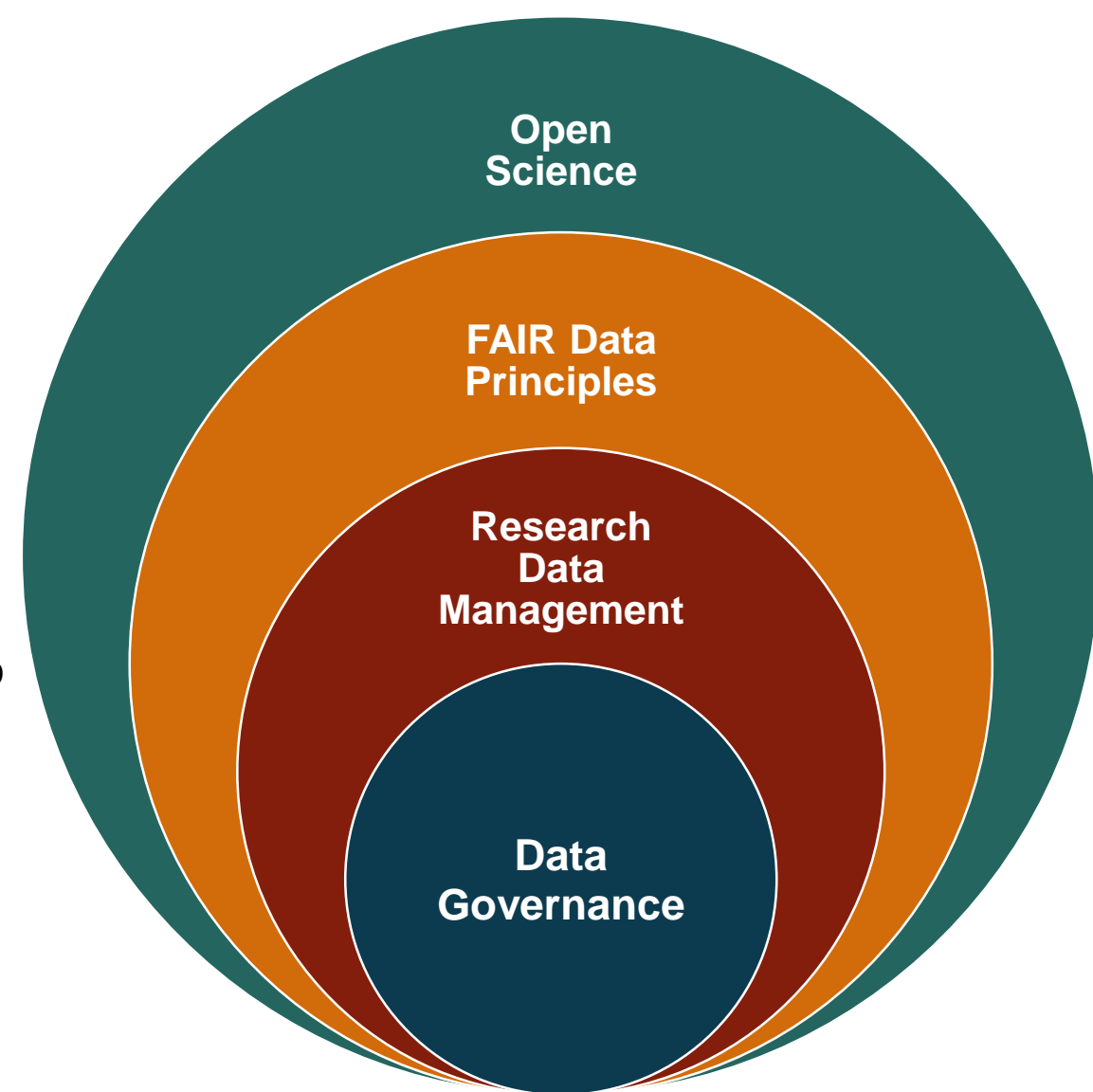


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**Promotion of Data Usability:** Beyond mere accessibility, the framework places a strong emphasis on the usability of data. It seeks to improve data provenance, quality, and general usability, thereby adding value to the research community.

**Rigorous Data Governance:** With stringent data governance standards, ORDMM guarantees the quality, integrity, and security of research data. This commitment to governance translates into a multifaceted, structured approach to data management.

**Compliance with Ethical and Legal Norms:** The framework meticulously ensures that all data management activities adhere to relevant ethical and legal guidelines, instilling a layer of trust and ensuring the ethical integrity of the research data.



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# Open Science is... cultural change.

**Open Science** refers to making scientific research, data, and dissemination accessible to all levels of society. Here are four key bullet points to encapsulate the concept:

- **Transparency in Methodology and Data:** Open Science advocates for sharing research methods, data sets, and tools to enable reproducibility and further inquiry. This is designed to improve the rigor and integrity of scientific research.
- **Public Access to Research Outputs:** Making research papers, publications, and results freely accessible. The aim is to distribute knowledge widely, often through open-access journals or public repositories.
- **Collaborative Research:** Open science encourages interdisciplinary collaboration and public engagement in the research process. Platforms may include community-based participatory research, citizen science projects, and other means of involving non-experts in the scientific process.
- **Promotion of Open Source and Open Standards:** Utilizing and contributing to open-source software, platforms, and common standards to facilitate the sharing and reusing of scientific data, methods, and tools.