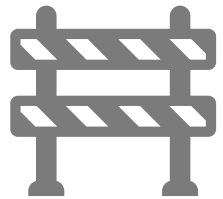
Navigating leadership in Open Science: challenges



Dr Sara Lil Middleton (she/her)

OSC LMU Open Science Center

FORRT

Prerequisites

- A foundational understanding of Open Science practices such as open access, preregistration, where training materials can be found here: https://www.osc.lmu.de/training/
- Leadership in Open Science: Skills, values and culture (access here)
- Access to the Open Research Workshop Design Workbook: https://lmu-osc.github.io/train-the-trainer-open-research/workshop-design-workbook/

Note:
These training materials form part of three sessions on leadership in Open Science:

1. Skills, values and culture (access here)
2. Challenges (current session)
3. Strategies (access here)

Survey

1. What is a particular challenge you have when it comes to adopting Open Science practices?

How confident are you in your ability to:

0 = not confident at all, 1 = mostly not confident, 2 = somewhat confident, 3 = very confident

2. identify which Open Science challenges are within my sphere of influence/control to address?

Session goals

Identify challenges in adopting Open Science practices and **examine** reasons behind them to raise awareness of possible barriers you and others may encounter.

To **distinguish** between challenges according to whether they occur at individual, interpersonal, institutional or systemic levels to practice a key problem-solving leadership skill.



Working through the 5A framework for navigating challenges

This session

Next session

See resources











Awareness

Noticing challenges in non-judgmental way

Acknowledge

Naming challenges, recognizing context, multiple perspectives can co-exist

Agency

Identifying where you have influence to act

Action (address, advocate, approach others)

Taking concrete steps towards addressing challenges, connecting with others

Assess

Reflecting on actions taken: were they effective? Has my sphere of influence changed?

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Working through the 5A framework for navigating challenges

Framework allows you to **practice** key leadership **skills** and **qualities**: self-awareness, empathy, knowledgeable, problem solvers, collaborative, flexibility

Steps shown linearly but in practice things are often not straightforward!



Awareness	Acknowledge	Agency	Action (address, advocate, approach others)	Assess
Noticing challenges in non-judgmental way	Naming challenges, recognizing context, multiple perspectives can co-exist	Identifying where you have influence to act	Taking concrete steps towards addressing challenges, connecting with others	Reflecting on actions taken: were they effective? Has my sphere of influence changed?

What challenges do you experience in implementing Open Science?

1. Self **reflect**

2. **Write** down short phrases or sentences

3. Group **discussion**



Awareness

~10 minutes

Challenges in Open Science: Time



Time

e.g. Time constraints in a project to carry out a preregistration

Challenges in Open Science: Overwhelm

Time



Overwhelm

e.g. Competing demands

Challenges in Open Science: Incentive structures

Time



Incentive structures

e.g. Narrow research evaluation metrics like H-index



Overwhelm

Challenges in Open Science: Lack of training/skills

Time

Incentive structures



Overwhelm



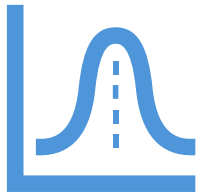
Lack of training/ skills

e.g. Training on how to make reproducible code

Challenges in Open Science: Norms and culture

Time

Incentive structures



Norms and culture

e.g. Different disciplinary norms and approaches to research



Overwhelm

Lack of training/ skills

Challenges in Open Science: Lack of support

Time

Incentive structures

Norms and culture



Overwhelm

Lack of training/ skills



Lack of support

e.g. Supervisor not supportive of making dataset open access

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Challenges in Open Science: Restrictions/inflexibility

Time

Incentive structures

Norms and culture



Restrictions/ inflexibility

e.g. Data protections for human data or protected species



Overwhelm

Lack of training/ skills

Lack of support

Challenges in Open Science: Limited resources

Time

Incentive structures

Norms and culture



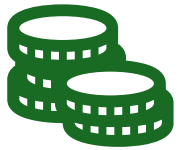
Restrictions/ inflexibility



Overwhelm

Lack of training/ skills

Lack of support



Limited resources

e.g. Funding for article processing charges (APCs) to make research open access

Challenges in Open Science: Additional workload

Time

Incentive structures

Norms and culture



Restrictions/ inflexibility



Additional workload

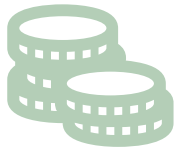
e.g. Large administrative workload in Big Team Science projects



Overwhelm

Lack of training/ skills

Lack of support



Limited resources

Challenges in Open Science: Career impact



Time

Incentive structures

Norms and culture



Restrictions/ inflexibility

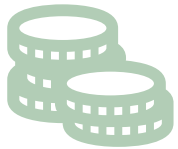
Additional workload



Overwhelm

Lack of training/ skills

Lack of support



Limited resources



Career impact

e.g. Contributions to open source infrastructure is undervalued

Challenges in Open Science: Equity issues

Time

Incentive structures

Norms and culture



Restrictions/ inflexibility

Additional workload



Equity issues

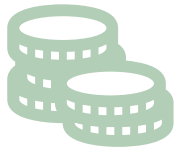
e.g. Data sovereignty (CARE principles: **C**ollective benefit, **A**uthority to control, **R**esponsibility and **E**thics)



Overwhelm

Lack of training/ skills

Lack of support



Limited resources



Career impact

Challenges in Open Science: AI technologies

Time

Incentive structures

Norms and culture



Restrictions/ inflexibility

Additional workload

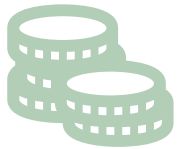
Equity issues



Overwhelm

Lack of training/ skills

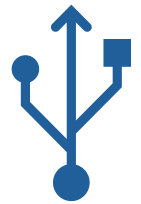
Lack of support



Limited resources



Career impact



AI technologies

e.g. Hallucinated references

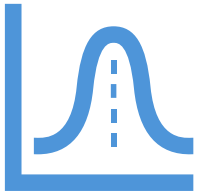
Challenges in Open Science



Time



Incentive structures



Norms and culture



Restrictions/ inflexibility



Additional workload



Equity issues



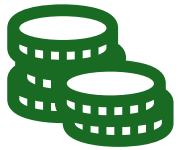
Overwhelm



Lack of training/ skills



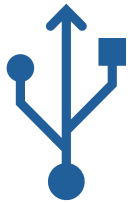
Lack of support



Limited resources



Career impact



AI technologies

See more: Gownaris et al. 2022

Challenges in Open Science

March 01 2023

The APC-barrier and its effect on stratification in open access publishing

Thomas Klebel, Tony Ross-Hellauer

Check for updates

Author and Article Information

Quantitative Science Studies (2023) 4 (1): 22–43.

https://doi.org/10.1162/qss_a_00245 **Article history**

PERSPECTIVE/OPINION | APRIL 29 2026

The Advantage of Big Team Science: Lessons Learned From Cognitive Science

Collections: Section: Methodology and Research Practice

David C. Vaidis, Jacob F. Miranda, Erin M. Buchanan, Yu Fang Yang, Marta Kowal, Kathleen Schmidt, Marta Topor, Michal Misiak, Rachael Miller, John Protzko, Biljana Gjoneska, Jeremy K. Miller, Anna Exner, Flavio Azevedo, Mariola Paruzel-Czachura, Faisal Mushtaq, Catia Oliveira, Jordan R. Wagge, Delphine De Moor, Niels G. Mede, Drew M. Altschul, Yuri G. Pavlov, Yashvin Seetahul, Leanne Boucher, Kimberly C. Doell, Ingmar Visser, Mahmoud M. Elsherif, Ekaterina Pronizius

Corresponding author: david.vaidis@univ-tlse2.fr

ronizius contributed equally and share the senior author position

us@univie.ac.at

Article history

RESEARCH ARTICLES | 06 JUL 2022

A survey on how preregistration affects the research workflow: better science but more work

Special Collection: Open science

Alexandra Sarafoglou ; Marton Kovacs ; Bence Bakos ; Eric-Jan Wagenmakers ; Balazs Aczel

+ Author & article information

R. Soc. Open Sci. (2022) 9 (7): 211997 .

https://doi.org/10.1098/rsos.211997 **Article history**

Review Article

Medicine

Eleven strategies for making reproducible research and open science training the norm at research institutions

Friederike E Kohrs, Susann Auer, Alexandra Bannach-Brown, Susann Fiedler, Tamarinde Laura Haven, Verena Heise, Constance Holman, Flavio Azevedo, René Bernard ... Tracey L Weissgerber see all »

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Nov 23, 2023 • https://doi.org/10.7554/eLife.89736

nature > news > article

NEWS | 19 May 2026 | Correction 19 May 2026

Researchers who use hallucinated references to face arXiv ban

The preprint server is the latest to impose stiff penalties on authors who contribute to AI 'slop' – but not everyone is convinced it's the right approach.

By Dalmeet Singh Chawla

Promoting inclusive metrics of success and impact to dismantle a discriminatory reward system in science

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Published: June 15, 2021 • https://doi.org/10.1371/journal.pbio.3001282

nature > scientific data > comment > article

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Stephanie Russo Carroll, Edit Herczog, Maui Hudson, Keith Russell & Shelley Stall

Scientific Data **8**, Article number: 108 (2021) | Cite this article

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Correspondence | Published: 27 February 2023

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Nature Ecology & Evolution **7**, 626–627 (2023) | Cite this article

British Journal of Social Psychology — the british psychological society

EDITORIAL

Opportunities, challenges and tensions: Open science through a lens of qualitative social psychology

Madeleine Pownall, Catherine V. Talbot, Laura Kilby, Peter Branney

First published: 31 January 2023 | https://doi.org/10.1111/bjso.12628 | VIEW METRICS

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Open Science is happening across scales

The diversity of **pathways** to Open Science (e.g. research, education, policy, infrastructure) bring about different **conceptual**, **practical** and **equity** challenges.

Acknowledgement

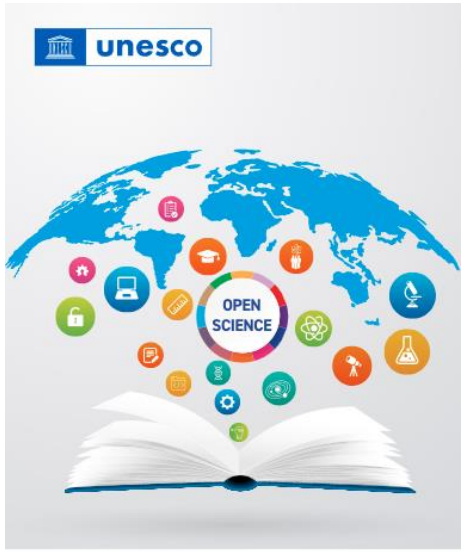


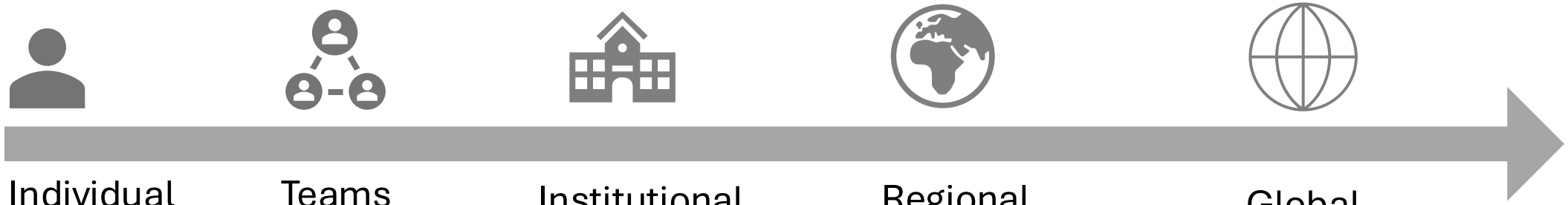
Open Science is happening across scales

The diversity of **pathways** to Open Science (e.g. research, education, policy, infrastructure) bring about different **conceptual**, **practical** and **equity** challenges.



You





Open Science is happening across scales

The diversity of **pathways** to Open Science (e.g. research, education, policy, infrastructure) bring about different **conceptual**, **practical** and **equity** challenges.

You

The **values**, **goals** and **standards**

How Open Science is
understood and **practiced**



UNESCO Recommendation on Open Science

Individual

Teams

Institutional

Regional

Global

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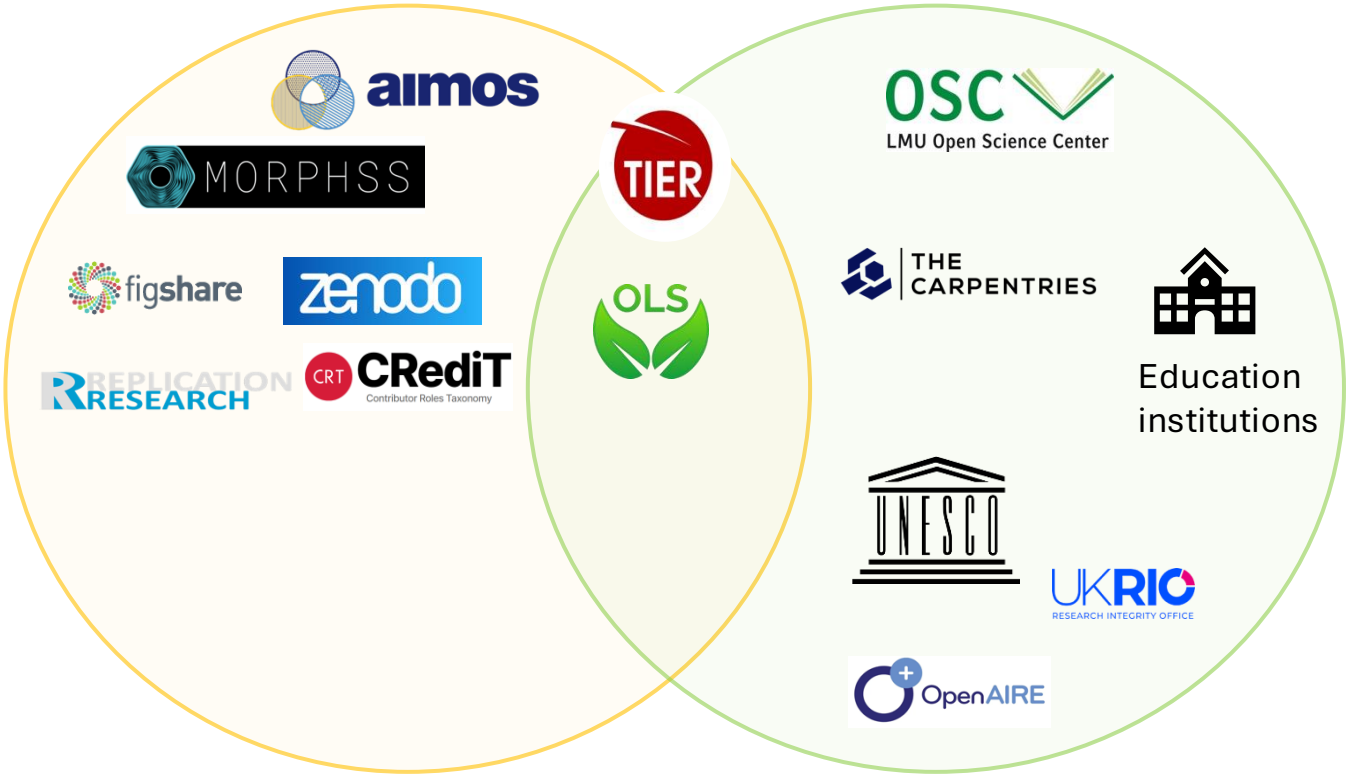
Challenges in Open Science: diversity of domains

Research & Scholarly communication



Challenges in Open Science: diversity of domains

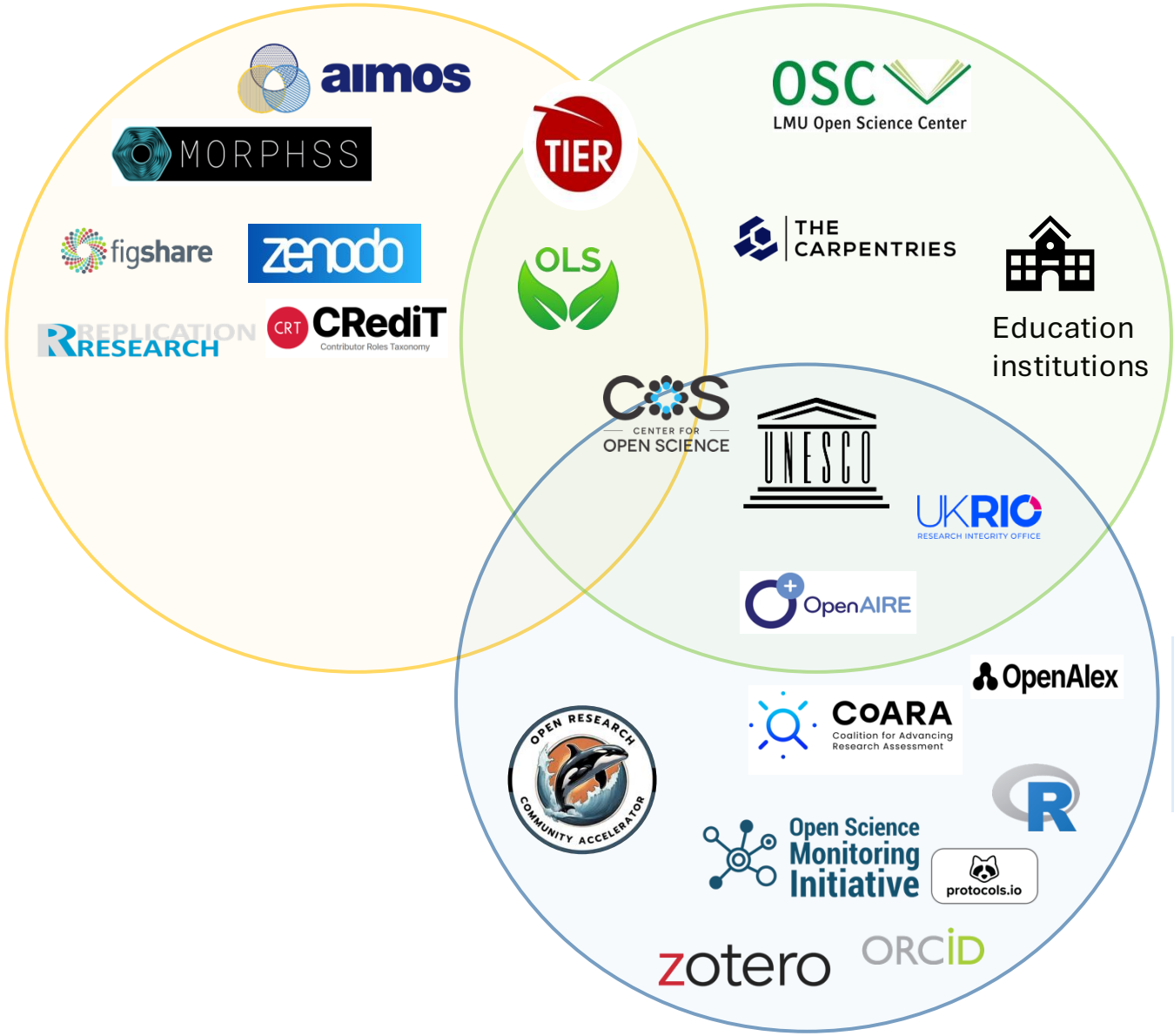
Research & Scholarly communication



Education & training

Challenges in Open Science: diversity of domains

Research & Scholarly communication



Education & training

Policy & infrastructure

OSC LMU Open Science Center FORRT

Challenges in Open Science: diversity of domains

Non-exhaustive list!

Research & Scholarly communication

Education & training

Community & networks

Policy & infrastructure

Business & Industry



See more here: https://amcm.shinyapps.io/openit/

A conceptual challenge in Open Science: terminology

‘Open Science’ means different things to people

5 Open Science schools of thought (Fecher & Friesike, 2014)



Democratic: Making knowledge freely available for everyone (e.g. open data, licensing)

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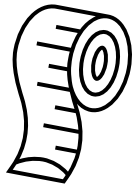
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Public: Making knowledge creation accessible to non-academics (e.g. Science communication, public participation)



Measurement: Developing alternative metrics for success and impact (e.g. altmetrics, authorship)

A conceptual challenge in Open Science: terminology

Confusion and lack of shared context of terminology can **create barriers** for non-native speakers, knowledge transfer and interdisciplinary collaborations (Parsons et al. 2022).



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Acronyms

e.g. Orcid iD (Open Researcher and Contributor ID)



Metaphors

e.g. Garden of forking paths, salami slicing



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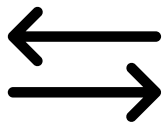




Additional meanings

e.g. Paper mills

- Factories manufacturing paper
- Organizations involved in science misconduct producing papers with falsified or fabricated data



Usage differences

e.g. Preregistration as a process and output (Mayo-Wilson et al. 2025), replication-reproducibility confusion



Creating new terms

e.g. #Bropenscience (Whitaker & Guest, 2020)

A practical challenge in Open Science: building accessible and sustainable infrastructure

There are **technical** and **organizational infrastructure** challenges in supporting researchers adopt Open Science practices across the research life cycle.

Research life cycle



Ihle et al. 2026

A practical challenge in Open Science: building accessible and sustainable infrastructure

There are **technical** and **organizational infrastructure** challenges in supporting researchers adopt Open Science practices across the research life cycle.

Stepping into the infrastructure school (Fecher & Friesike, 2014), practical issues:

- **Funding** for **development**
- **Monitoring** and **maintenance**
- **Governance**
- **FAIR (F**indability, **A**ccessibility, **I**nteroperability, and **R**euse)
- **Global forces** (e.g. geopolitics)

Research life cycle



Ihle et al. 2026

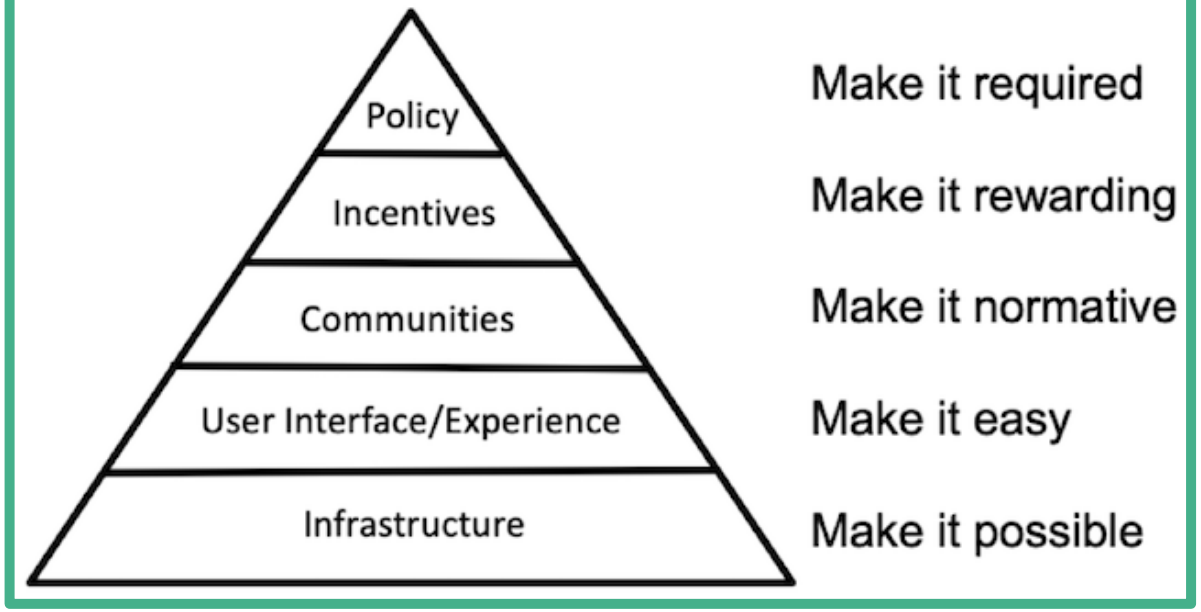
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Culture change pyramid



Adapted from Nosek (2019)

A practical challenge in Open Science: building accessible and sustainable infrastructure

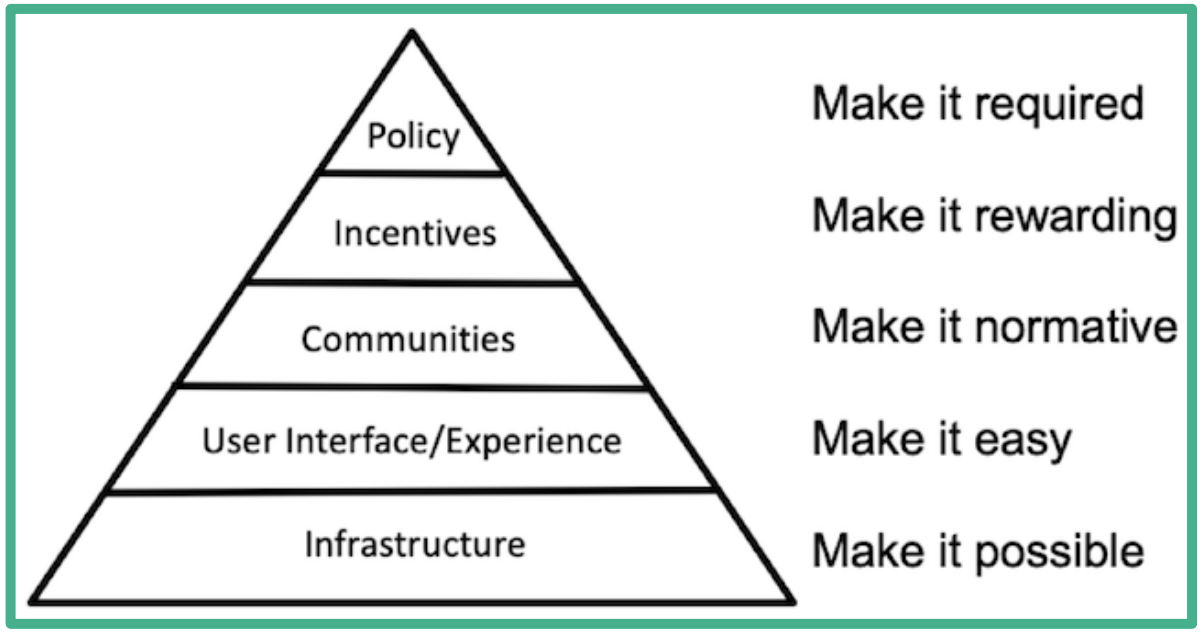
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Note: Culture change pyramid has been critiqued due to overemphasis of infrastructure as a technical issue issue in Open Science.

Culture change pyramid



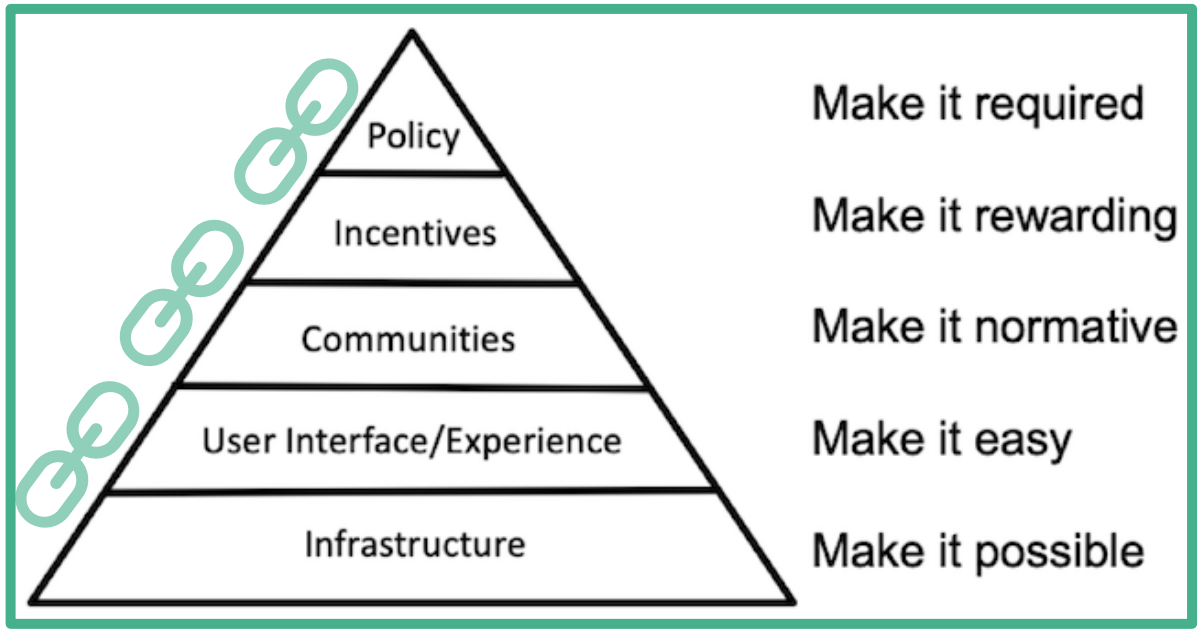
Adapted from Nosek (2019)

See Principles of Open Scholarly Infrastructure (POSI) https://openscholarlyinfrastructure.org/

A practical challenge in Open Science: Building organizational infrastructure

Building **organizational infrastructure** (e.g. **workflows, team structure, fora**, etc.) to foster communication and collaboration between domains and scales.

Culture change pyramid



Adapted from Nosek (2019)

A practical challenge in Open Science: Building organizational infrastructure

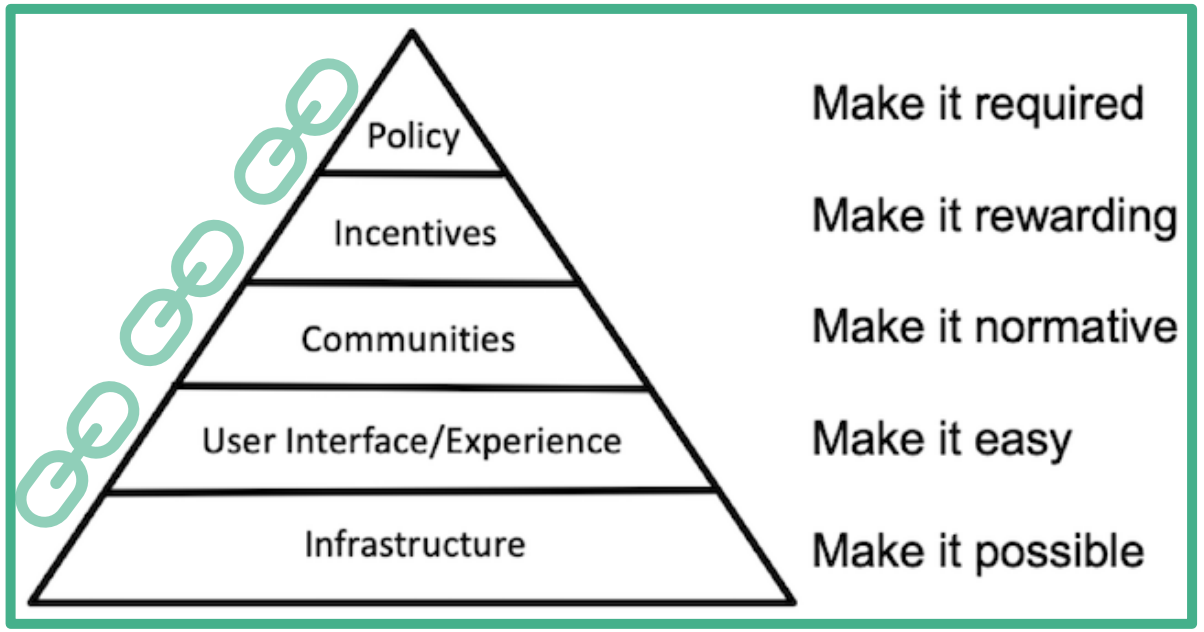
Building **organizational infrastructure** (e.g. **workflows, team structure, fora**, etc.) to foster communication and collaboration between domains and scales.

Practical issues:

- Navigating tensions
- **Recognition**
- Avoiding **duplicated efforts**
- **Regulations**
- **Digital divide**
- **Usefulness** and **effectiveness**

Think about all the technical tools or services you use on a daily basis in your work!

Culture change pyramid



Adapted from Nosek (2019)

Importance of sustainable infrastructure: The case of the Open Science Framework (OSF)

- The Open Science Framework (OSF) publicly launched in 2012 and as of 2026, has 1 million registered users!

- A **centralized repository** and **research workflow platform** to support sharing of data and materials in collaborative teams

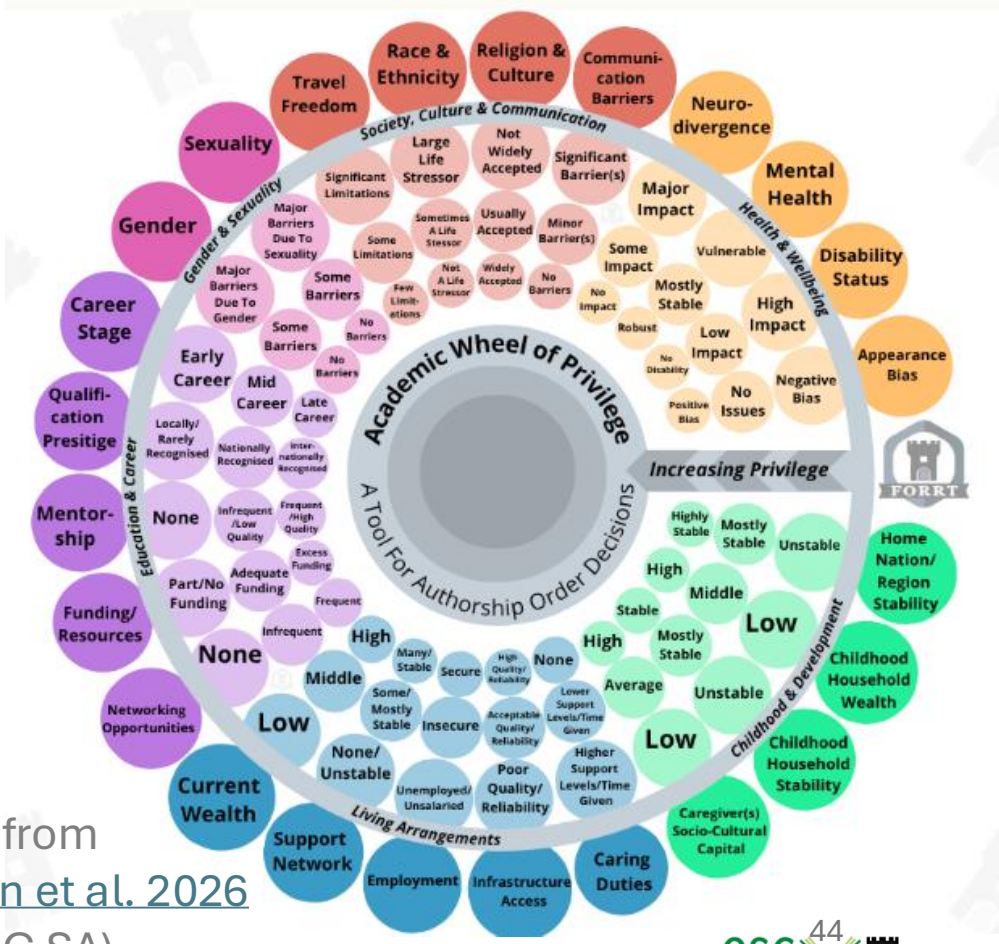
- From November 2026, OSF projects are to be phased out due to **increased maintenance costs** ($4-5 million USD per year), **decreased long term funding** and **scope creep** (Nosek, 2026).



Read more about the changes: https://www.cos.io/blog/osf-changes-a-note-to-users

Open Science challenges around equity: contributions, credit and capacity building

Not considering **equity** and **(social) justice,** risks **replicating** the **status quo** and perpetuating harm to **under-represented communities**.



Equity = Fairness based on need
Justice = Transformation of the system by removing cause of inequity to ensure fairness for all

Adapted from Middleton et al. 2026
(CC BY NC SA)

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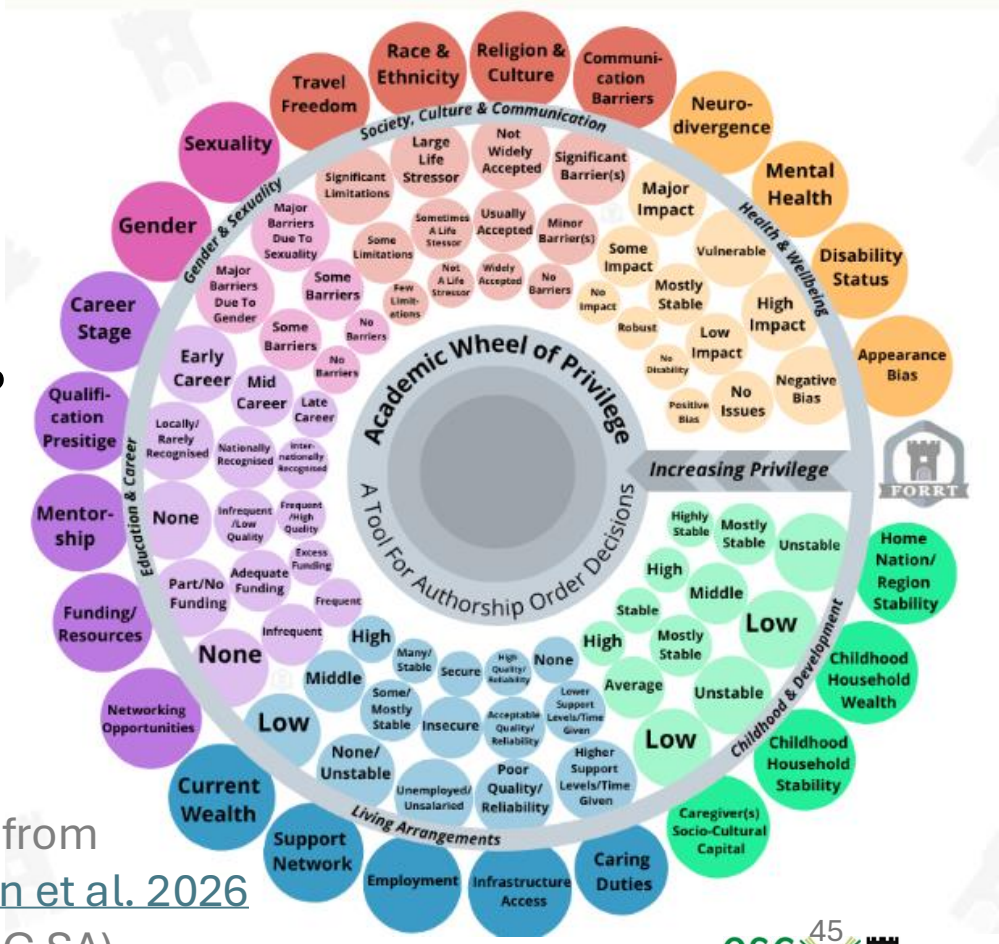
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Equity issues:

- **Biases**
- Who decides the **standards**?
- Whose knowledge do we **value** and **acknowledge**?
- How are people from **under-represented communities impacted**?

Equity = Fairness based on need
Justice = Transformation of the system by removing cause of inequity to ensure fairness for all



Adapted from Middleton et al. 2026 (CC BY NC SA)

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FAIR data management also needs CARE

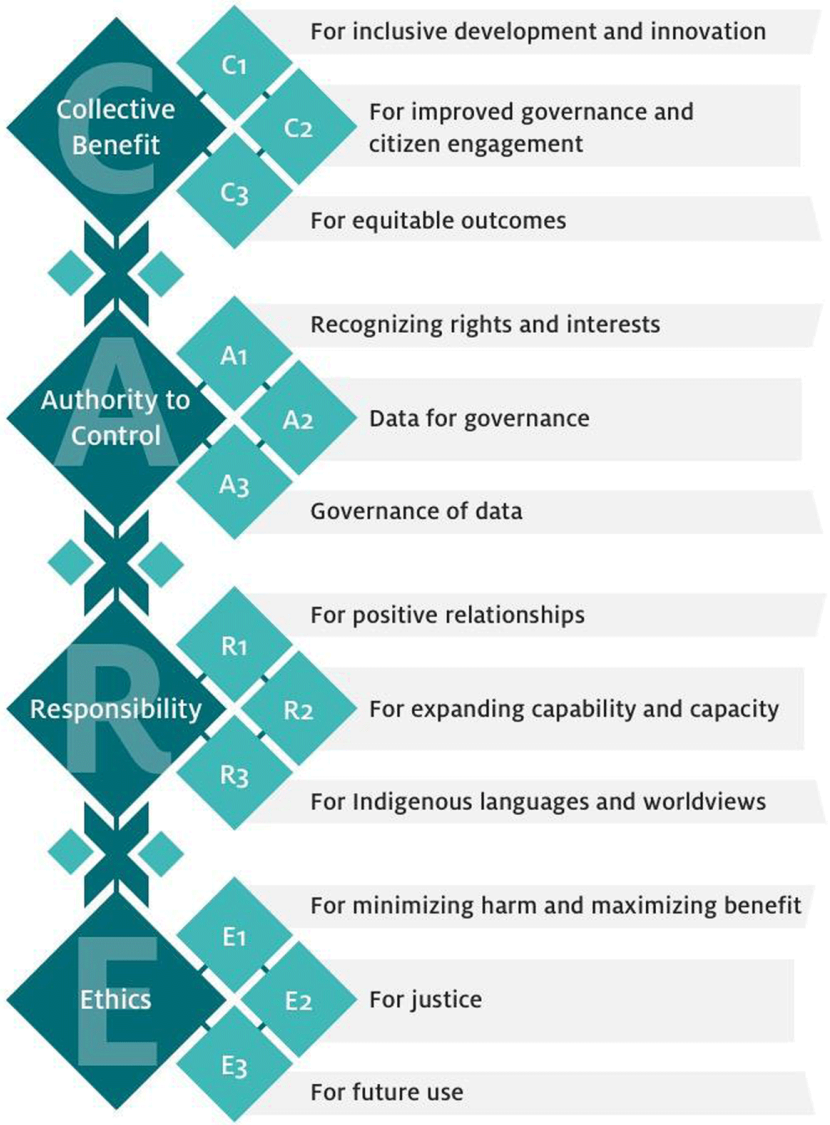


Image from Carroll et al. (2020)

FAIR asks: Are people able to access and reuse these data?
Technical infrastructure focus

CARE asks: Should these data be accessible and to whom? Who decides?
Equity and ethics focus

Consider CARE Principles when working with:

- Indigenous communities
- Vulnerable or marginalized communities

FAIR = Findable, Accessible, Interoperable and Reusable
CARE = Collective Benefit, Authority to Control, Responsibility, and Ethics

Open Science challenges around equity and (social) justice

Gender & Society
OnlineFirst
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https://doi.org/10.1177/08912432261466293

Sage Journals

Article

Women as the First Open Scientists: Five Stories of the Neglected Contributions of Women in (Social) Science Reform History

Madeleine Pownall

Perspective | Open access | Published: 29 January 2025

A manifesto for a globally diverse, equitable, and inclusive open science

Sakshi Ghai, Rémi Thériault, Patrick Forscher, Yuichi Shoda, Moin Syed, Arathy Puthillam, Hu Chuan Peng, Dana Basnight-Brown, Asifa Majid, Flavio Azevedo & Leher Singh

Communications Psychology **3**, Article number: 16 (2025) | Cite this article

See OSC training module on citation politics:
https://lmu-osc.github.io/train-the-trainer-student-track-pedagogy/materials/PMM-M4/PMM-M4-S3-Citation-Politics/PMM-M4-S3-Citation-Politics.html

Advances in Methods and Practices in Psychological Science
Volume 8, Issue 3, July 2025
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https://doi.org/10.1177/25152459251357565

Sage Journals

General Article

Open Science in the Developing World: A Collection of Practical Guides for Researchers in Developing Countries

Hu Chuan-Peng [1,2], Zhiqi Xu [3], Aleksandra Lazić [4], Piyali Bhattacharya [5], Leonardo Seda [6,7], Samiul Hossain [8], Alma Jeftić [9,10], Asil Ali Özdoğru [11], Olavo B. Amaral [12], Nadica Miljković [13,14], Zlatomira G. Ilchovska [5,15], Ljiljana B. Lazarevic [4], Han Wu Shuang Bao [16,17], Nikita Ghodke [18], David Moreau [19,20], Mahmoud Elsherif [5,21], Chinchu C. [22,23], Sakshi Ghai [24], Clarissa F. D. Carneiro [11,25], Danka Purić [4], Yin Wang [26], Mirela Zaneva [27], Felipe Vilanova [28,29], Iris Žeželj [4], Obrad Vučkovac [30], Saida Heshmati [31], Pooja Kulkarni [32], Nadia Saraí Corral-Frías [33], Juan Diego García-Castro [34,35], Shubham Pandey [36,37], Jamal Amani Rad [38], Thipparapu Rajesh [39], Bita Vahdani [40], Saad Almajed [21,41], Amna Ben Amara [42], Leher Singh [43], Ali H. Al-Hoorie [44], Marcelo Camargo Batistuzzo [6,45,46], Daniel Fatori [6,47], Frankie T. K. Fong [48,49], Zahra Khorami [21], Joseph Almazan [50], Biljana Gjoneska [51], Meng Liu [52], and Flavio Azevedo [53]

Cite Black Women: A Critical Praxis (A Statement)

Christen A. Smith [1], Erica L. Williams [2], Imani A. Wadud [3], Whitney N. L. Pirtle [4], & The Cite Black Women Collective [1]

1 The University of Texas at Austin
2 Spelman College
3 University of Kansas
4 University of California, Merced

Corresponding author: The Cite Black Women Collective; e-mail: citeblackwomen@gmail.com

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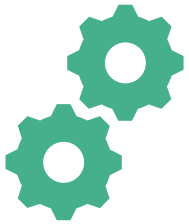
Challenges in Open Science: AI technologies

Rapid usage of artificial intelligence (**AI) technologies** throughout the **research life cycle** presents **conceptual, practical** and **equity challenges**



Ambiguity around AI **terminology** (e.g. large language models vs chatbots).

Implications for scientific understanding?



Large volume of AI-generated work affecting the **evaluation** of research outputs.

Implications for preprint servers, peer review, funding panels?



AI reduces **engagement** (e.g. **outsourcing** questions to AI chatbot vs talking with an expert).

Implications for value of human expertise, team dynamics?

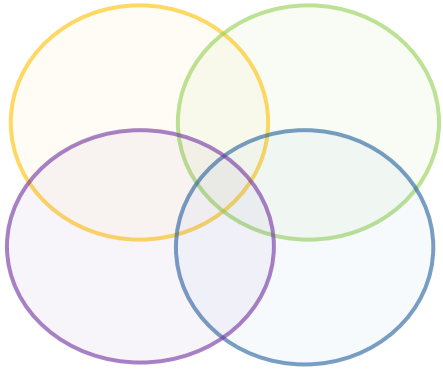
Guest et al. 2026, Hao et al. 2026

Recap on Open Science challenges

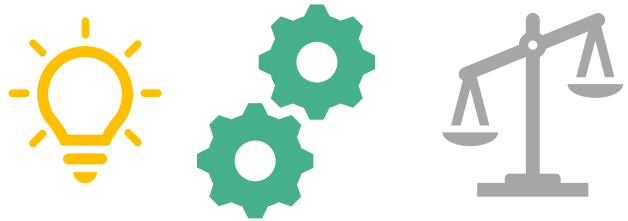
We've Identified challenges in adopting Open Science practices



and **examined** some reasons behind them



Diversity of domains



Conceptual, practical and equity challenges

What does leadership in Open Science/Scholarship mean to you?



Richard Dushime Mudahera

Data Science at University of Messina

Website Lead at FORRT (Framework for Open and Reproducible Research Training)

"Leadership in Open Science means **building** the roads others can travel and ensuring those roads remain open.

It means **creating transparent**, **community-owned** infrastructure that makes sharing data, reproducing results, and collaborating across institutions **accessible** and **sustainable**.

True leadership is **not about visibility**; it is about **creating** the **conditions** where **openness** becomes the default from Day 1."

The scale of the challenges



Systemic

Whole systems (e.g. academic ecosystem)



Institutional

Embedded policies/practices that provide scaffolding of systems



Inter-personal

Interactions and behaviors between people and teams



Individual

Personal behaviors

Note:
Identifying which scale the challenge is -> addressing it

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The scale of the challenges



Systemic



Incentive structures



Institutional



Lack of support



Inter-personal



Lack of training/ skills



Individual



Time

Note:
Challenges don't always fit neatly onto the scale!

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Sphere of influence

Which challenges are in our control or influence to address?

Agency



Reflection question:
For a given challenge, am I able to address it by myself or can I partly influence (via my actions and behavior) how the challenge impacts me?

Where is our sphere of influence?

Systemic

Institutional

Inter-personal

Individual

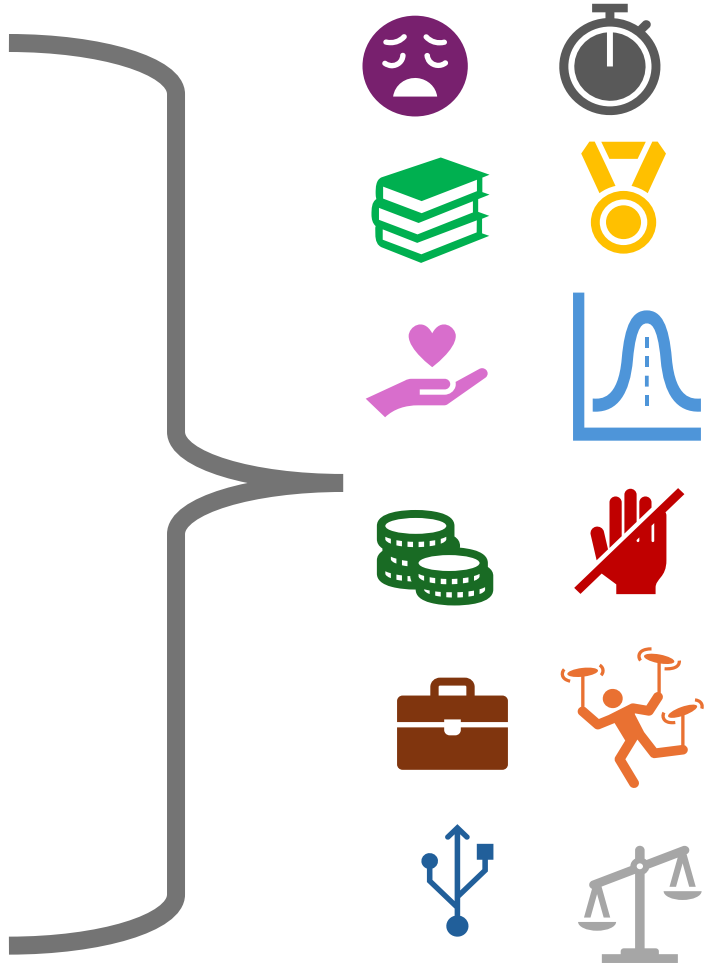
We generally have more control and influence for challenges at this scale



To act or not to act?

Categorizing the list of challenges can help us with **decision making** and **reduce overwhelm**!

Scale of challenge	Level of control/influence over challenge	
	Partly within my control/influence	*Outside* my control/influence
	Stay aware 👀	***Acknowledge and let go*** 🏄
Systemic *(e.g. the academic ecosystem)*		
Institutional *(e.g. your institution or organisation)*		
	Within my control/influence	*Outside* my control/influence
	Act, address and advocate 📣	***Acknowledge and assess later*** 🔁
Interpersonal *(e.g. your colleagues, team mates, students)*		
Individual *(yourself)*		



Exercise in mapping our challenges

Scale of challenge	Level of control/influence over challenge	
	Partly within my control/influence	*Outside* my control/influence
	Stay aware 👀	***Acknowledge and let go*** 🏄
Systemic *(e.g. the academic ecosystem)*		
Institutional *(e.g. your institution or organisation)*		
	Within my control/influence	*Outside* my control/influence
	Act, address and advocate ✍️	***Acknowledge and assess later*** 🔁
Interpersonal *(e.g. your colleagues, team mates, students)*		
Individual *(yourself)*		

1. **Write** down a couple Open Science challenges in section 8.1 of the workbook: https://lmu-osc.github.io/train-the-trainer-open-research/workshop-design-workbook/

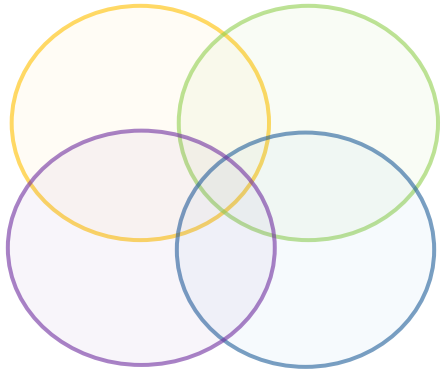
2. For each challenge, **categorize** them into the grid (use the reflection question to help you in section 8.2)

3. **Extension:** For one challenge in the green zone set out a **next step** to address the challenge

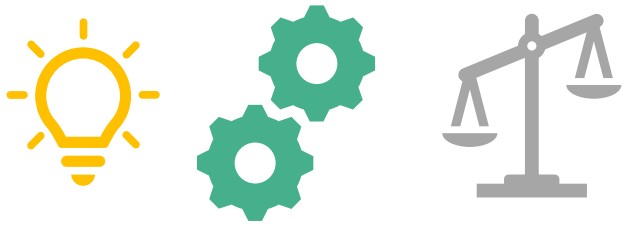
Reflection question:
For a given challenge, am I able to address it by myself or can I partly influence (via my actions and behavior) how the challenge impacts me?

~8 minutes

Final summary



How Open Science is **understood** and **practiced** differs across the domains (e.g. a student vs policymaker)



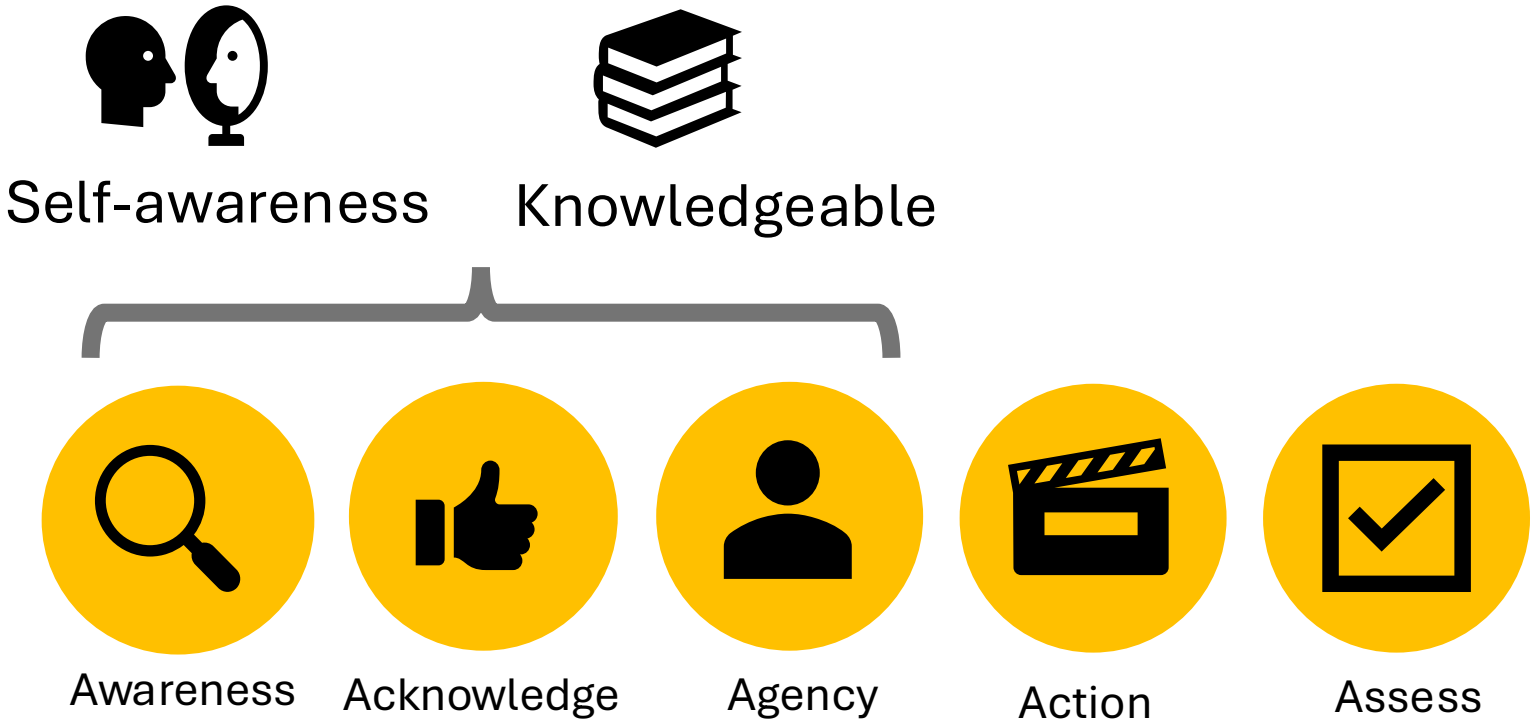
Conceptual, **practical** and **equity challenges** remain in Open science (e.g. terminology, infrastructure and credit)



Mapping challenges and identifying **sphere of influence** is a step towards addressing barriers

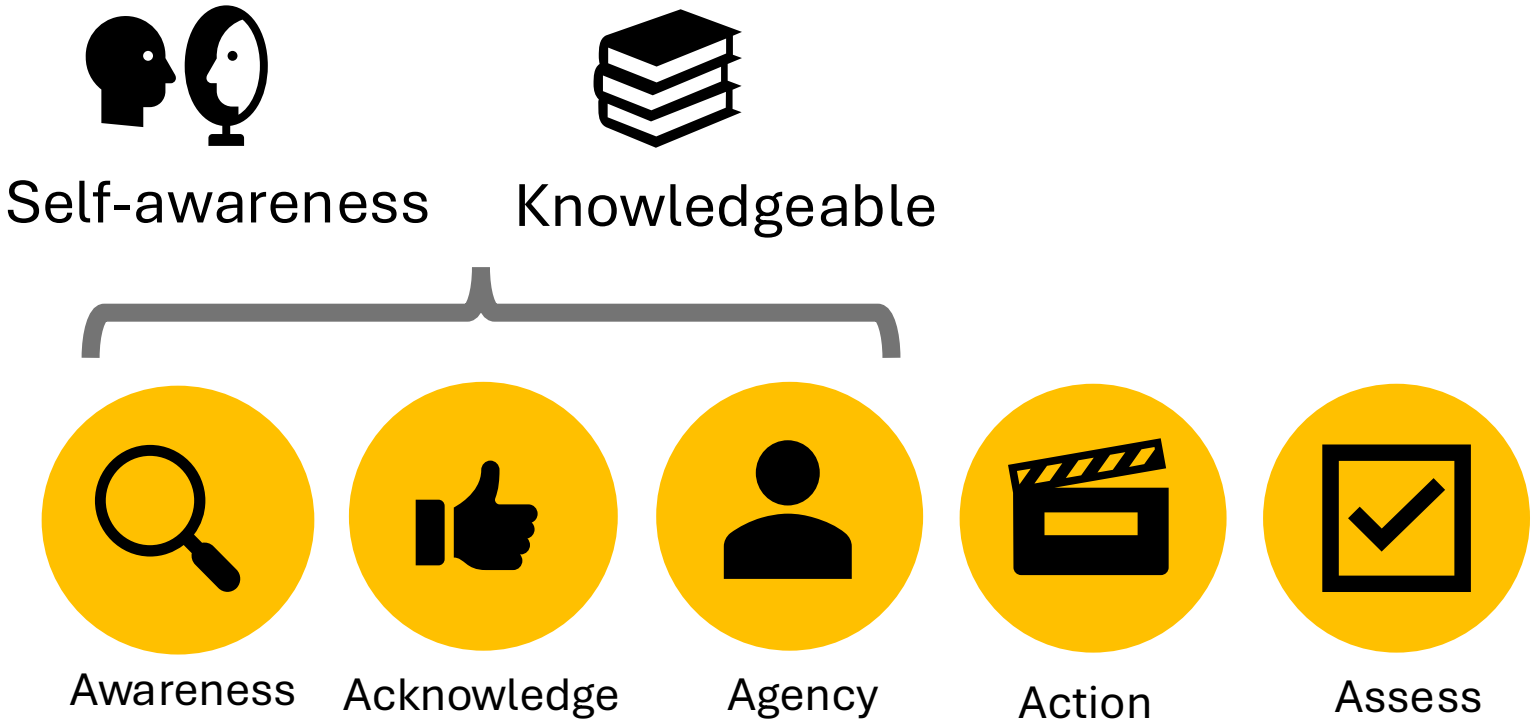
Leadership qualities we practiced

Using the 5A framework we worked on increasing our **self-awareness** and **knowledge**



Leadership qualities we practiced

Using the 5A framework we worked on increasing our **self-awareness** and **knowledge**



In the next session we will work on:



Next session:
Strategies in leadership: access here

What does leadership in Open Science/Scholarship mean to you?



Prof. Brian Nosek

Co-founder and Executive Director of the Center for Open Science (COS)

Professor of Psychology, University of Virginia

"Leadership in Open Scholarship means adopting behaviors that **prioritize "getting it right"** over "being right".

Leadership in Open Scholarship means **pursuing transparency** to open **oneself** to scrutiny, foster **reuse**, and **promote public knowledge**.

Leadership in Open Scholarship means trying to live the **ideals** of scholarly research in **one's daily practice**."

Survey

1. What is a particular challenge you have when it comes to adopting Open Science practices?

How confident are you in your ability to:

0 = not confident at all, 1 = mostly not confident, 2 = somewhat confident, 3 = very confident

2. identify which Open Science challenges are within my sphere of influence/control to address?

Questions

Contribution statement

Creator: Middleton, Sara Lil (0000-0001-5307-8029)
Reviewer: Verheyen, Steven (0000-0002-6778-6744),
von Grebmer zu Wolfsthurn, Sarah (0000-0002-6413-3895)

Acknowledgements:
Sharing leadership expertise:
Richard Dushime Mudahera, Brian Nosek

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