



Enabling Open and Reproducible Research

Tony Ross-Hellauer, Nicki Lisa Cole, Thomas Klebel

Open & Reproducible Research Group,
Graz University of Technology & Know-Center

ISDS PhD retreat

September 26, 2022



<https://orrg.eu/>

Open Science: Opening up scientific processes and products from all levels to everyone ...

- Open Access (publications)
- Open/FAIR Data
- Open Source software
- Open methods, protocols & materials
- Citizen Science
- Open Evaluation / Open Peer Review



Principles of Open Science

Transparency

Accountability

Inclusivity

Responsibility

Collaboration

Visibility

Rigour

Equality

Public good

Reproducibility

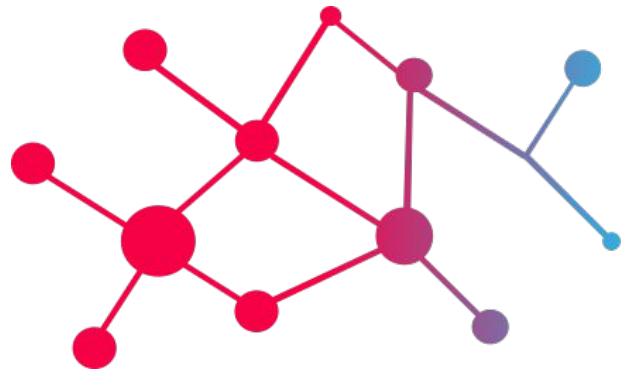
Findability

Accessibility

Interoperability

Re-usability

Innovation



ORRG

Open and Reproducible Research Group

<https://orrg.eu/>

Research group based at TU Graz and Know-Center

Qual and quant methods to research uptake and efficacy of open and reproducible research

on  merriT

 PTIMA

PathOS

 TIER²

Open Science → Equity?

The ON-MERRIT project

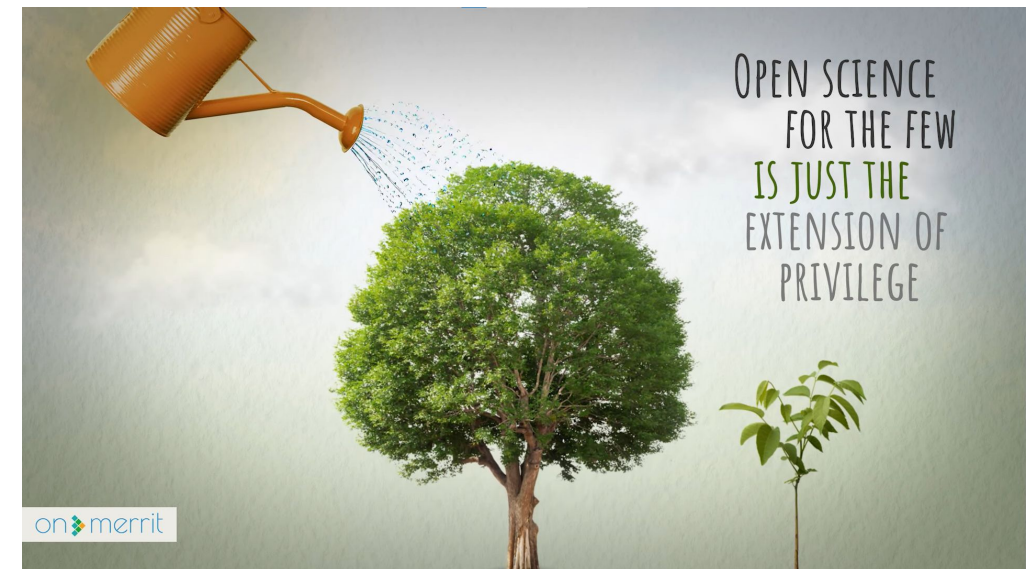
<https://on-merrit.eu>

- H2020 project: October 2019 - March 2022
- Methods: Sociological, bibliometric and computational approaches



Objectives

- Ensure that Open Science & RRI interventions contribute to a more equitable scientific system
- Distribution of rewards based on merit rather than privilege

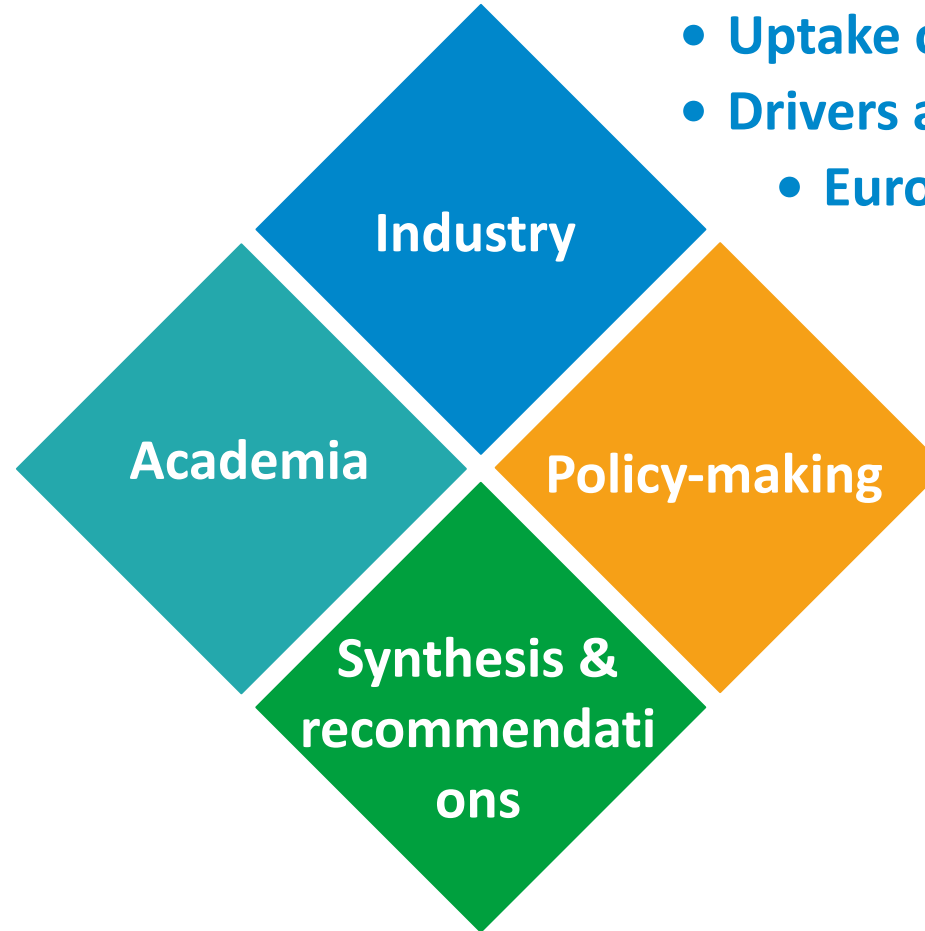




Key research questions & methods

Effects of...

- barriers to accessing literature
- OS & RRI practices on career progression
- OS & RRI indicators in promotion policies
- OS & RRI training



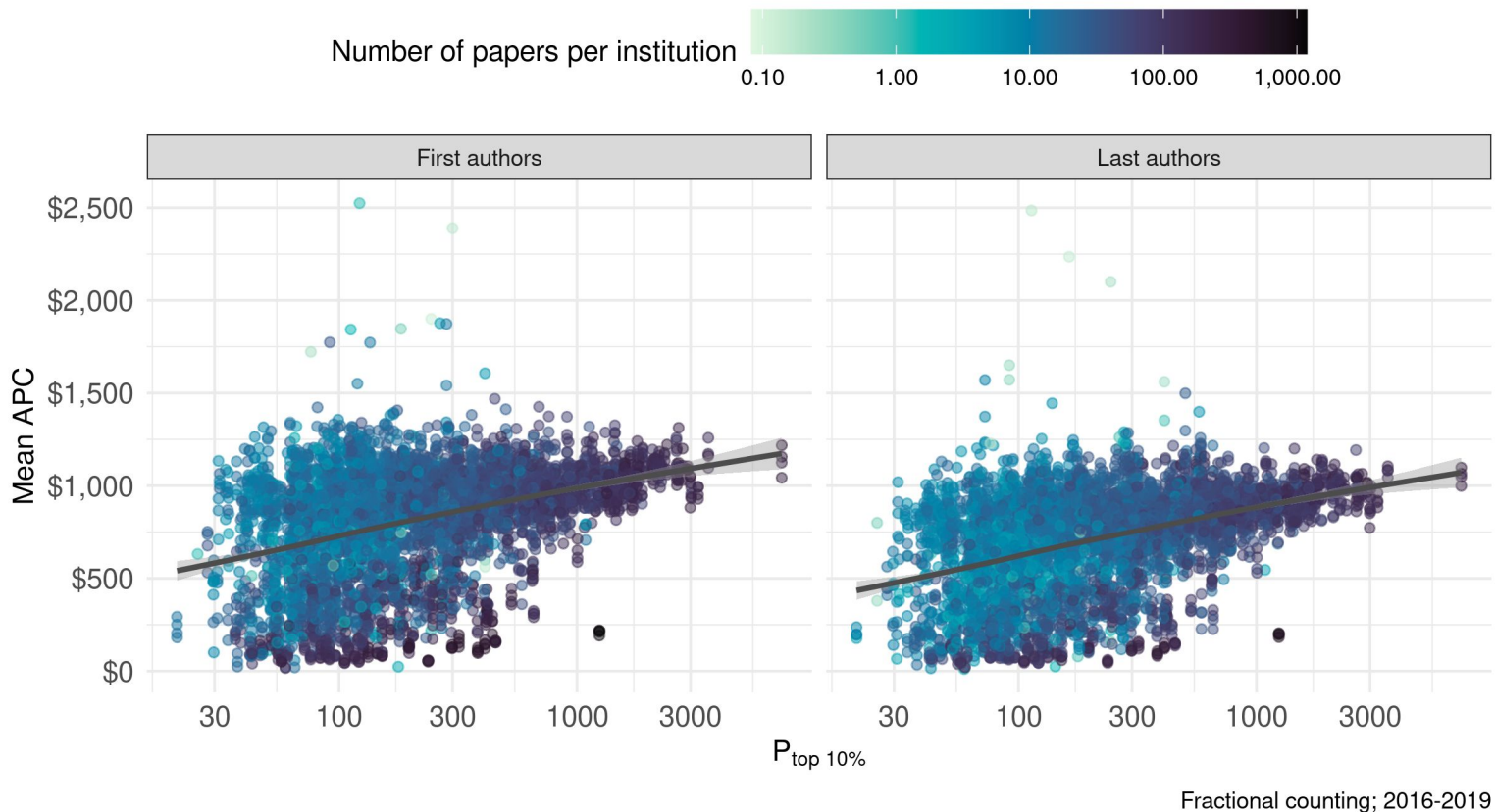
- Uptake of OS resources
- Drivers and barriers
 - European patent literature

- Uptake of OS resources
- Drivers and barriers
- With RRI experts & citizen scientists: Reflect on barriers to participate in evidence-gathering

- Effects of traditional vs. potentially new OS & RRI indicators on research practices

The issue with Article Processing Charges (APCs)

Institutional resources and APCs are linked



There is an association between institutional resources and average APCs

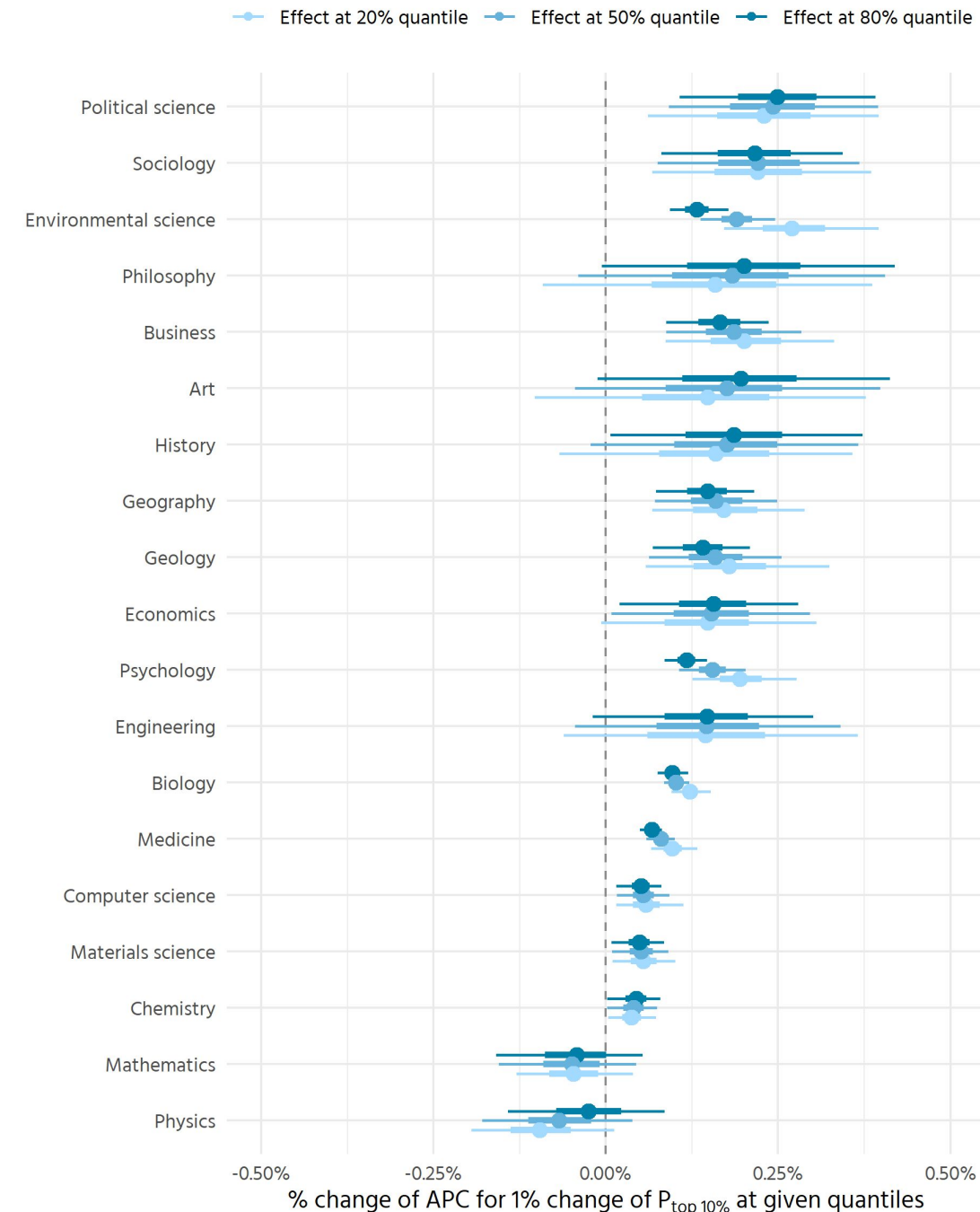
Might be explained by other factors (country, field)

Multilevel mixing: fields differ

Bayesian multilevel hurdle model to control for field and country effects.

We find:

- Small to moderate effect of institutional resources on APCs in most fields
- Strongest effects in social sciences
- Inverse effect in „Mathematics“ and „Physics“: better resourced institutions publish more in OA journals with *no APC*



Summary: Stratification in APC-based OA

Researchers from better resourced institutions publish more APC-based OA and pay higher APCs

OA publishing involving APCs is creating a new barrier for who can publish where

Implications

- Voices from societies and communities less embedded in global science are further marginalised
- Global issues need global perspectives, APC-OA is leading to the opposite
- Existing inequities are amplified (citation advantage, future reward structures)

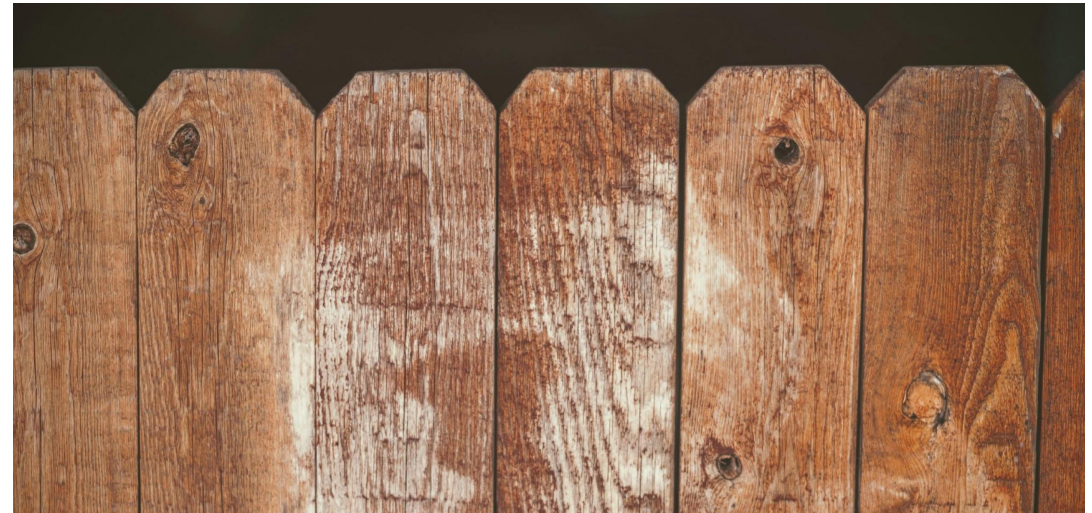
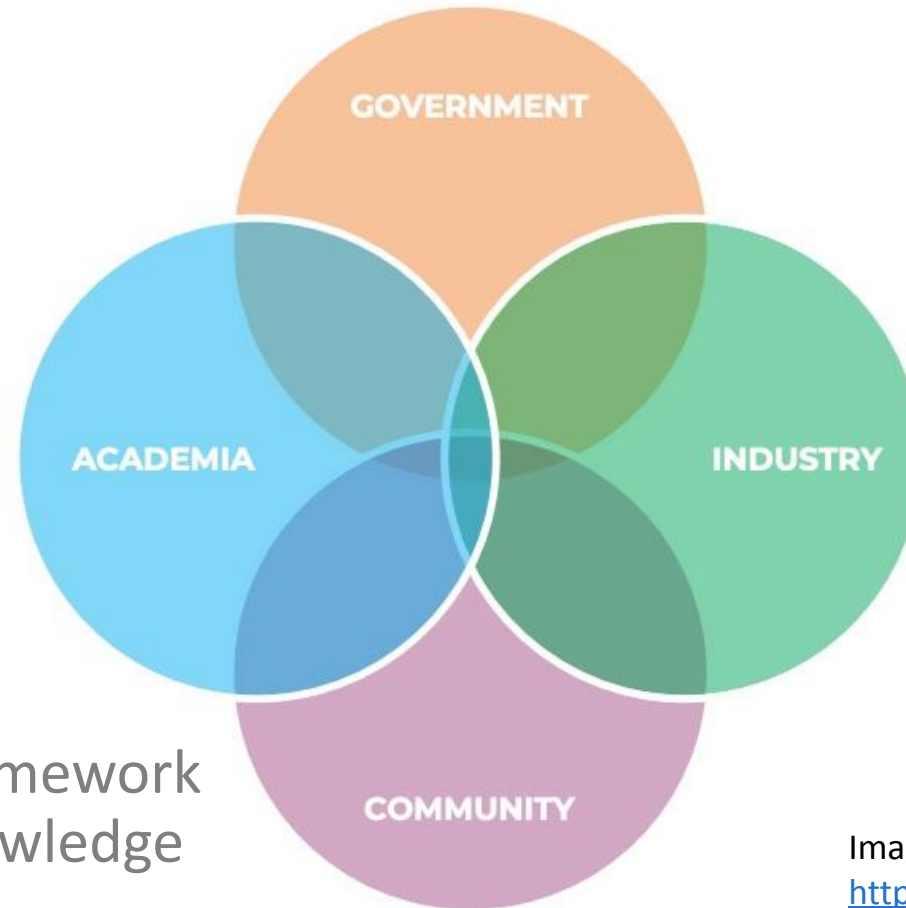


Photo by [Joshua Hoehne](#) on [Unsplash](#)

Beyond Open: Conducting Responsible Research

- Responding to global challenges with Responsible Research and Innovation (RRI)
- Make R&I processes and outputs **transparent, accessible, participatory, inclusive, equitable, ethical** and **responsive** to the needs, expectations and values of society
- RRI is “a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society)” (René Von Schomberg)

The Quadruple Helix



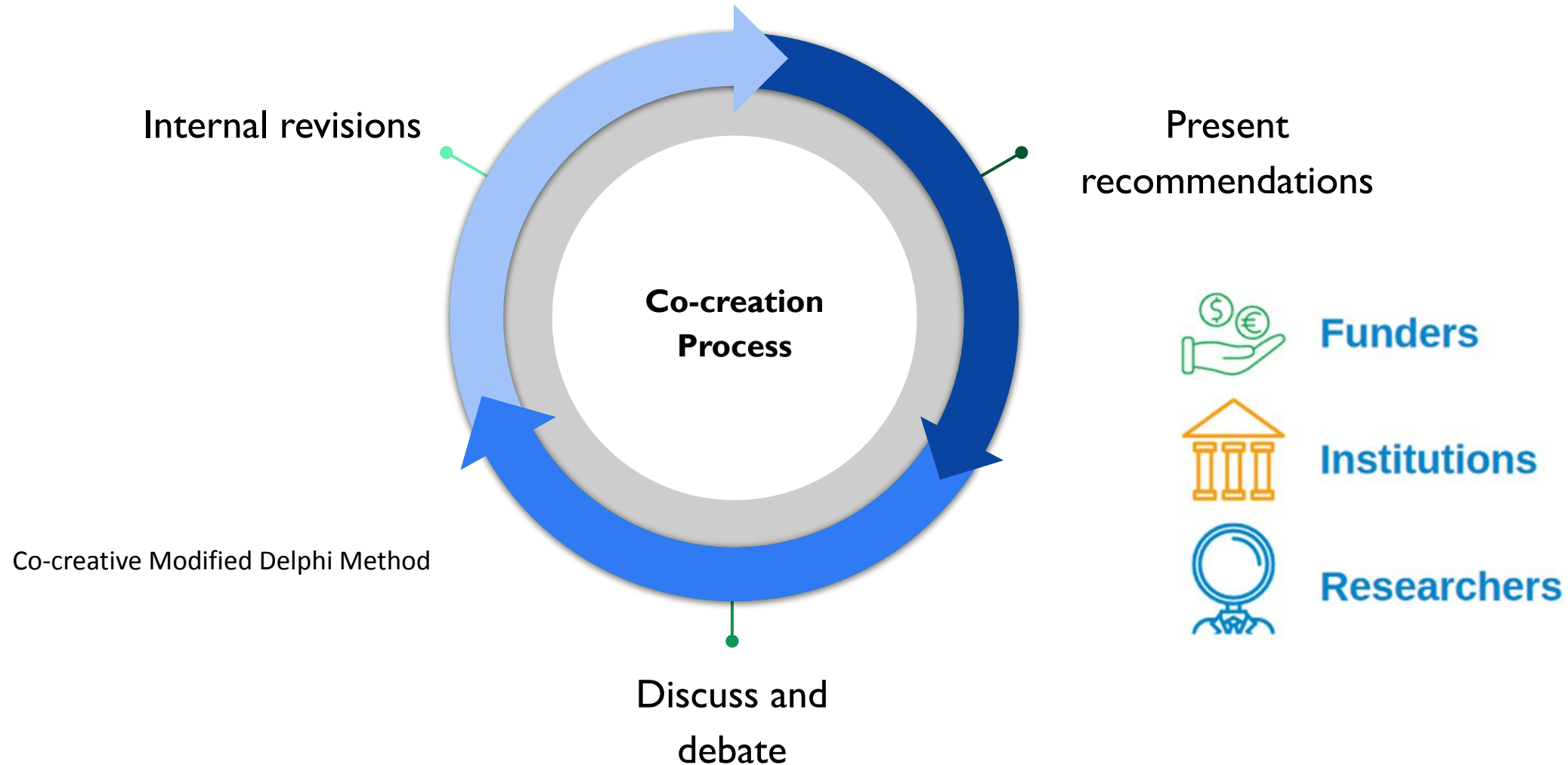
The quadruple innovation helix framework describes interactions within a knowledge economy.

Image credit:
<https://grip.eu/why-is-quadruple-helix-engagement-so-important/>

Implementing RRI

- Considerable funding and support from from Horizon Europe
- Enabling factors to doing RRI
- Benefits to doing RRI

Example: Co-Creating ON-MERRIT Recommendations



Discussion

- Questions, or?
- Is equity a consideration in your research process, and if so, in what ways?
- What does responsible research mean to you? How do you operationalise it?
- Do you think your R&I process would benefit from an RRI/quadruple helix approach?

Coming soon ...

TIER2: ENHANCING TRUST, INTEGRITY AND EFFICIENCY IN RESEARCH THROUGH NEXT-LEVEL REPRODUCIBILITY IMPACT PATHWAYS



New 2m EUR EC-funded project starting Jan 2023

Case-study, co-creative approach to creating and evaluating new reproducibility tools and practices



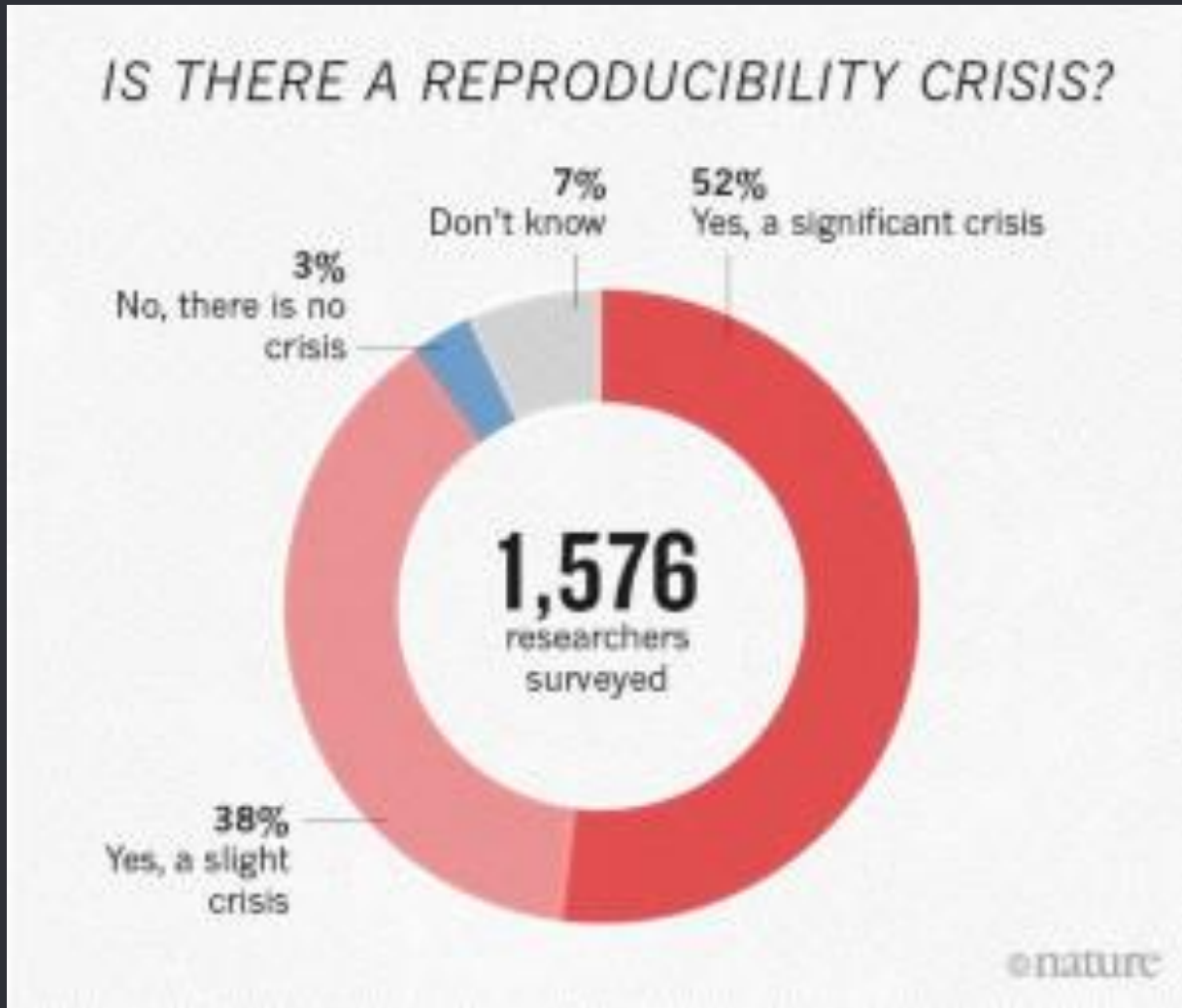
● Reproducibility

○ **Reproducibility:** Definitions of reproducibility (and replicability, etc.) vary widely.

In the broad sense we refer to the possibility for the scientific community to **obtain the same results** as the originators of a specific finding.

- **Computational reproducibility:** Same finding obtained using same dataset, experimental setup and methodology;
- **Replicability:** Same finding obtained from the same or similar analytical method on different datasets. Can be further delineated:

- 2016 - “Survey sheds light on the ‘crisis’ rocking research.”



Baker, M. 1,500 scientists lift the lid on reproducibility. *Nature* 533, 452–454 (2016).
<https://doi.org/10.1038/533452a>

● Epistemic diversity

○ “Reproducibility for data-intensive research comes in a variety of forms geared to specific features of the research environment at hand, especially:

- Assumed degree of control over research conditions
- Dependence on statistics as inferential tool
- Precision of the research goals
- Dependence on researchers’ judgement”

- Sabina Leonelli

Leonelli, S. (2018), "Rethinking Reproducibility as a Criterion for Research Quality",
<https://doi.org/10.1108/S0743-41542018000036B009>

Reproducibility in Computer Science

nature

Search  Login

Explore content  About the journal  Publish with us 

TECHNOLOGY FEATURE | 24 August 2020

Challenge to scientists: does your ten-year-old code still run?



35th AAAI Conference on Artificial Intelligence

A Virtual Conference

February 2–9, 2021

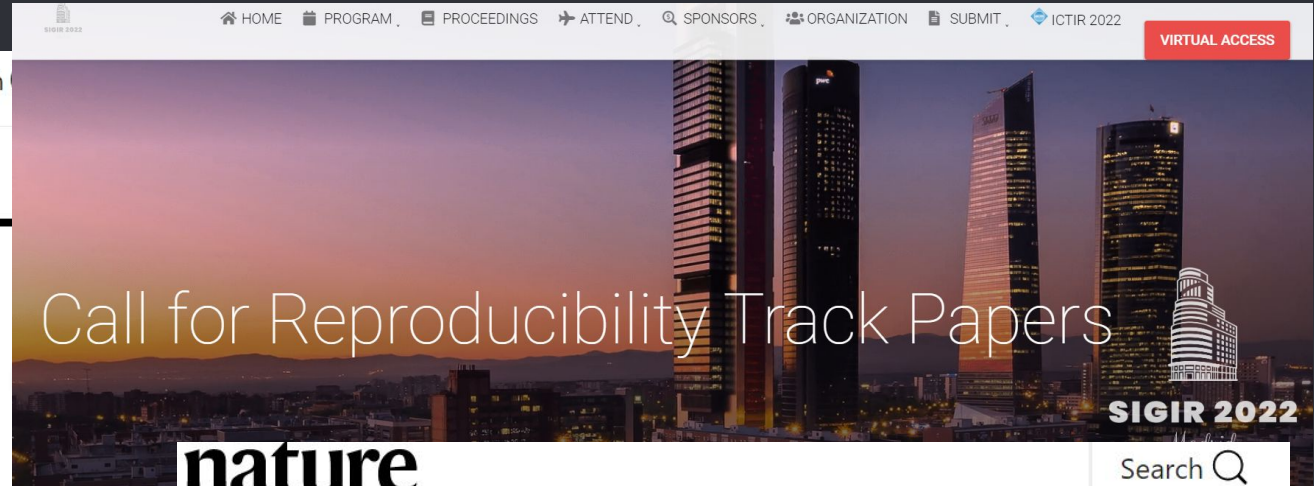


PROGRAM  CALLS  STUDENT PROGRAMS  EXHIBITORS ORGANIZATION  SPECIAL EVENTS 

Reproducibility Checklist

Unless specified otherwise, please answer “yes” to each question if the relevant information is described either in the paper itself or in a technical appendix with an explicit reference from the main paper. If you wish to explain an answer further, please do so in a section titled “Reproducibility


HOME PROGRAM PROCEEDINGS ATTEND SPONSORS ORGANIZATION SUBMIT ICTIR 2022 **VIRTUAL ACCESS**



Call for Reproducibility Track Papers

SIGIR 2022

nature

Search 

Explore content  About the journal  Publish with us 

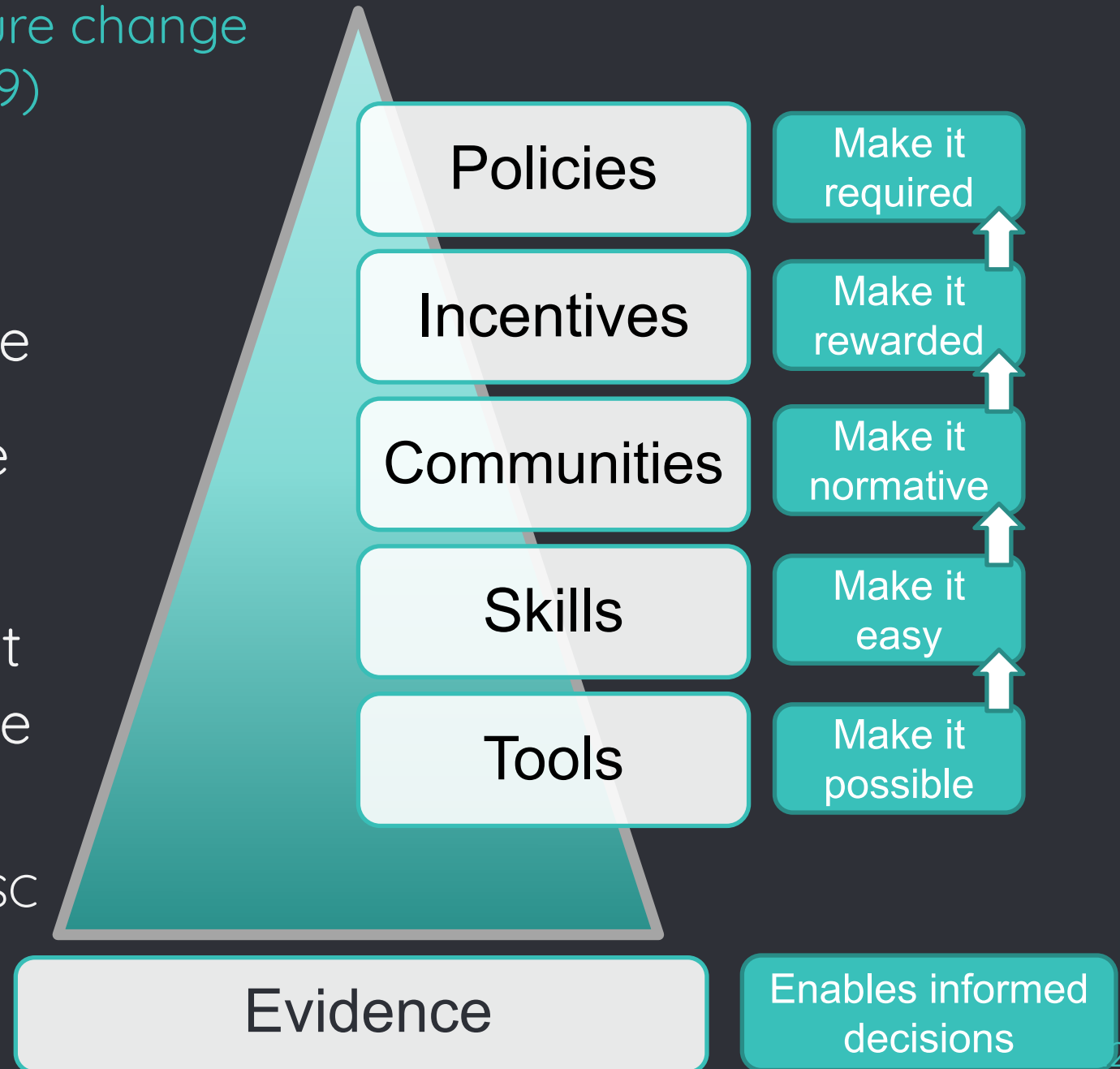
NEWS | 26 July 2022

Could machine learning fuel a reproducibility crisis in science?

‘Data leakage’ threatens the reliability of machine-learning use across disciplines, researchers warn.

Elements of research culture change (adapted from Nosek, 2019)

- So many building blocks to put in place
- Coordinated change across all levels
- Building on the great strides already made
 - Repro Networks
 - **Open** infras, e.g., EOSC



Provisional Framework for mapping impact pathways to optimal reproducibility

SOURCES OF EPISTEMIC DIVERISTY

Material – Conceptual – Methodological
Infrastructural – Socio-cultural – Institutional

INPUTS

Tools
Skills
Communities
Incentives
Policies

Evidence
Funds

ACTIVITIES

New tools and services
- Planning
- Data collection
- Data analysis
- Publication/sharing
- Assessment
Networking and capacity-building
Enhanced awareness and training
New incentives for reproducible practices

OUTPUTS

Reproducible Workflows
Open Data
Open Code
Enhanced skills
Improved awareness of biases
Improved behaviours
Networks of practitioners

OUTCOMES

Increased proportion of reproducible results from publicly-funded R&I
Increased re-use of scientific results by R&I
Greater quality of scientific production

IMPACTS

Increased integrity, efficiency and excellence of R&I
Greater societal trust in science

STAKEHOLDERS

Researchers – Funders – Publishers
Institutions – Scholarly/learned societies – Infrastructure providers
Policy-makers – Civil Society – Industry – Knowledge-transfer

NETWORK & EMPOWER

Co-creation - Strategic Alignment
Training - Skills - Reproducibility Hub

6

1

CONCEPTUALISE

Conceptual framework for epistemic diversity across cases

Scope the evidence
Inventory tools and practices



2

DESIGN

Future studies to prioritise design elements

Co-creation of pilots

Develop assessment framework



3

IMPLEMENT

Develop & pilot tools for

- Researchers
- Publishers
- Funders

to enable & monitor reproducibility



4

ASSESS

Implement pilot assessment framework

Synthesise findings to evaluate gains & savings



5

RECOMMEND & REFLECT

Co-create future roadmap & policy recs

Reflect on TIER2 radical reproducibility practices



USE CASES

Social Sciences - Life Sciences - Computer Science/AI
Publishers - Funders

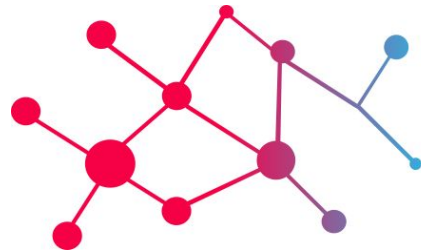
New tools for researchers, publishers, funders

- Reproducibility Hub (incl. checklists)
- Reproducibility planning tools
- Reproducible research workflows
- Data/code review workflows
- Standards for threaded publications
- Reproducibility monitoring



Thanks for listening!

 PTIMA



ORRG

PathOS

on  merrit


TIER