PathOS_EU

PathOS

Open Science Impact Pathways

Attributing Academic, Societal and Economic impact to Open Science

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OpenAIRE

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Athena RC | OpenAIRE | OPIX

Funded by the European Union

Open Science promises significant academic – societal – economic benefits

Are our plans working?

Image : Envato Elements

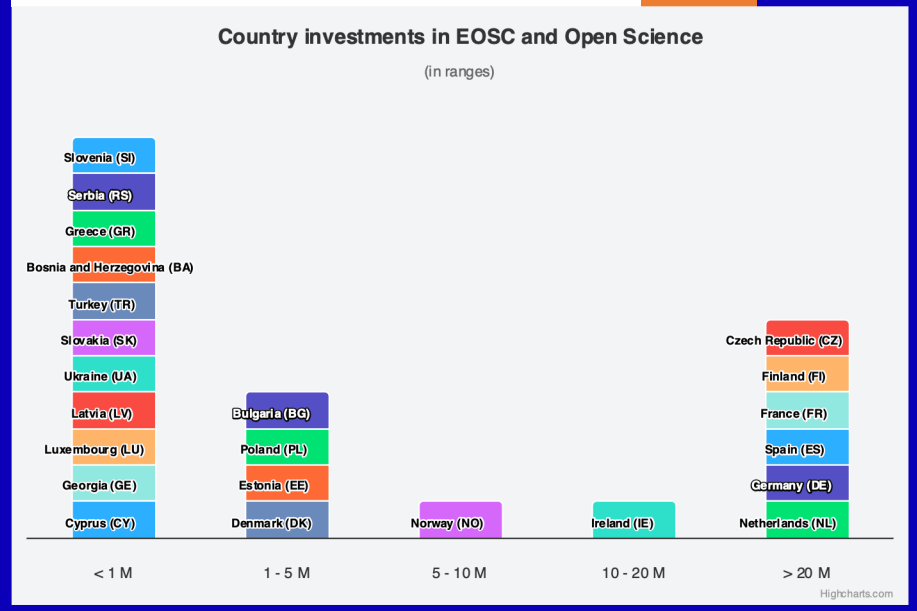
Investments, expectations & returns

eosc OBSERVATORY

Total amount of financial investments in EOSC and Open Science in 2021 (in millions of Euro)

400.89 M

2022



- Impact comes in many shapes and forms, very often intangible
- Are we investing in the right instruments to truly realize the promise?
- Are we achieving expected outcomes?
- What key pathways and enablers are driving the impact?
- How can we measure and monitor impacts and accurately attribute them to Open Science?

PathOS Objective

Identify and quantify the **Key Impact Pathways of Open Science** across **academia**, **society**, **and the economy** to enhance understanding and drive informed policy-making.

Beyond state of the art

- Map the **Causal Pathways** for Open Science
- Design and estimate **OS Impact Indicators** for selected case studies
- Use **data-driven, AI-assisted** methodologies
- Formulate a **Cost-Benefit Analysis** framework for Open Science

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PathOS

Open Science Impact Pathways

Programme: Horizon Europe

Call: HORIZON-WIDERA-2021-ERA-01

Type of Action: Research and Innovation

Topic: Modelling & quantifying the impacts of Open Science practice

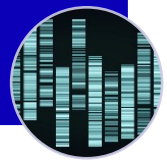
Grant Agreement No.: 101058728

Duration: Sep 2022 – Aug 2025

Based on Investigative Case Studies

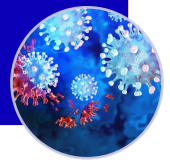
Innovation from Open Research resources - ELIXIR

Bioinformatics



Open Science practices during the Covid-19 pandemic

COVID-19



Emerging AI: Impact on Climate and Gender through Open Science

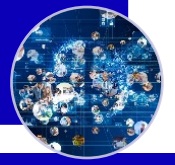
Emerging Topics

Cross cutting effects due to open research data from national repository

EASY – The Netherlands

Research data and knowledge use / uptake in non-academia

FRANCE

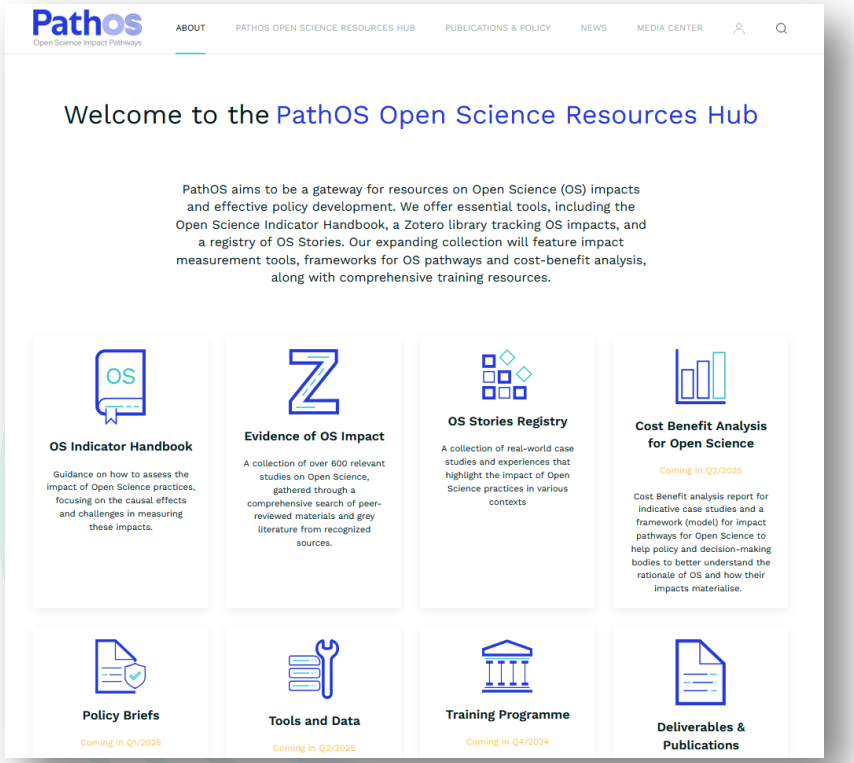


Accelerating collaborations within academia & industry

RCAAP - Portugal

Key Outputs

https://pathos-project.eu/



Frameworks

01

- OS Impact Pathways
- Cost-Benefit Analysis for OS

Handbook of OS Indicators

02

- Indicator "Recipes"
- Tools and Datasets

Literature Insights & Registry

03

- Lit Review on OS impacts
- Online registry of OS stories

Case Study Deep Dives

04

- OS impact assessments, Causality focus
- Cost-Benefit evaluations *(Elixir UniProt & RCAAP case studies)*

Training & Engagement

05

- Training for policy-makers & research administrators

Recommendations

06

- Guidelines and best practices
- Project-derived insights

Literature Review
Existing evidence for Impact

725 Scientific Papers

https://www.zotero.org/groups/5331667/the_academic_societal_and_economic_impacts_of_open_science/library

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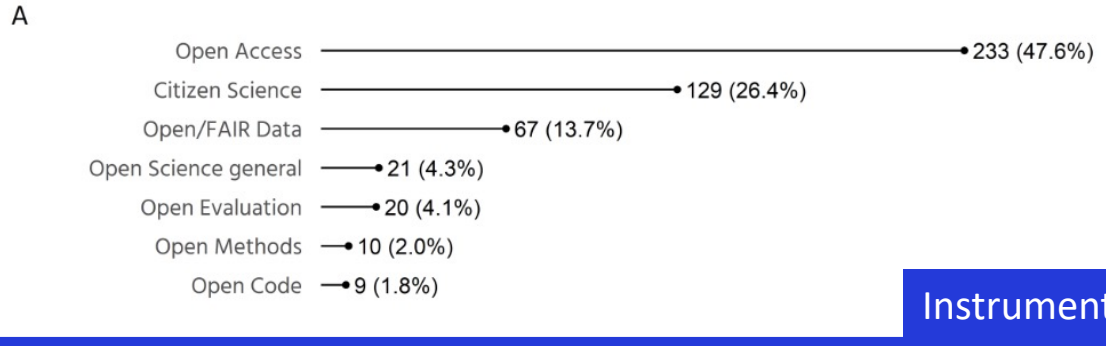
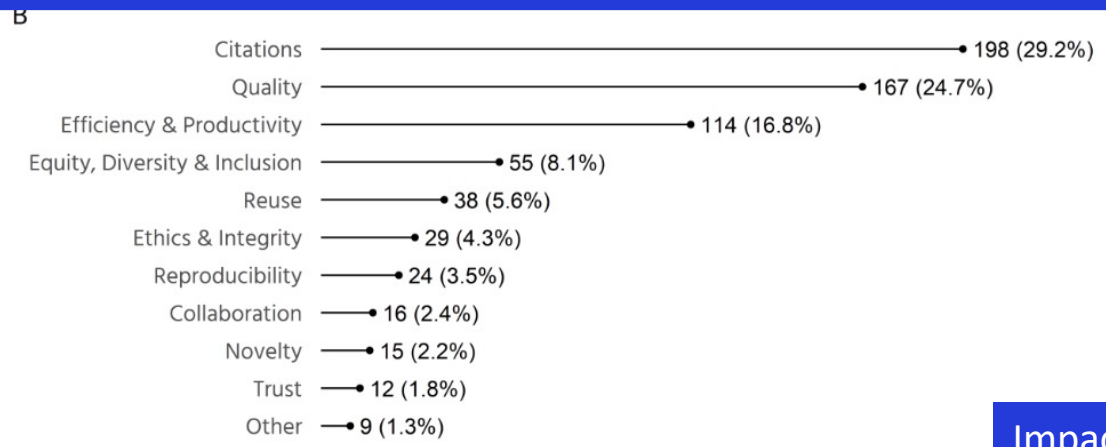
Existing Evidence

Mechanisms that drive impact: public participation, collaborative creation of data, uptake of data and stakeholder engagement

Academic Impact

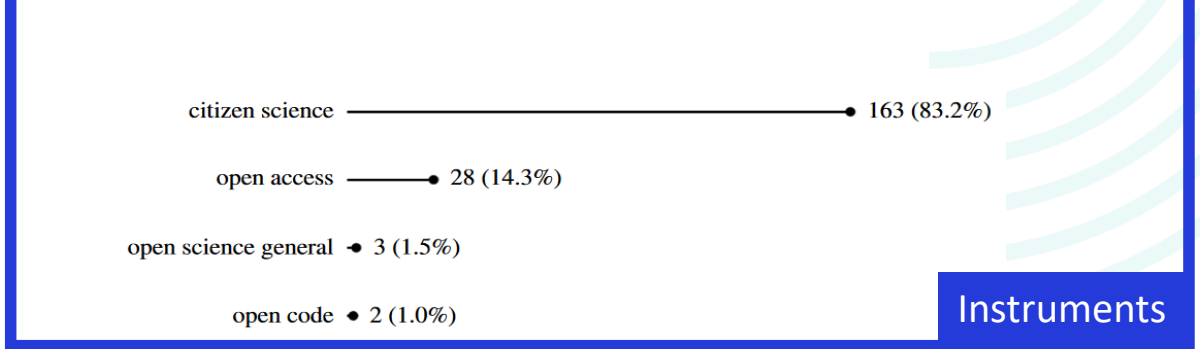


Instruments

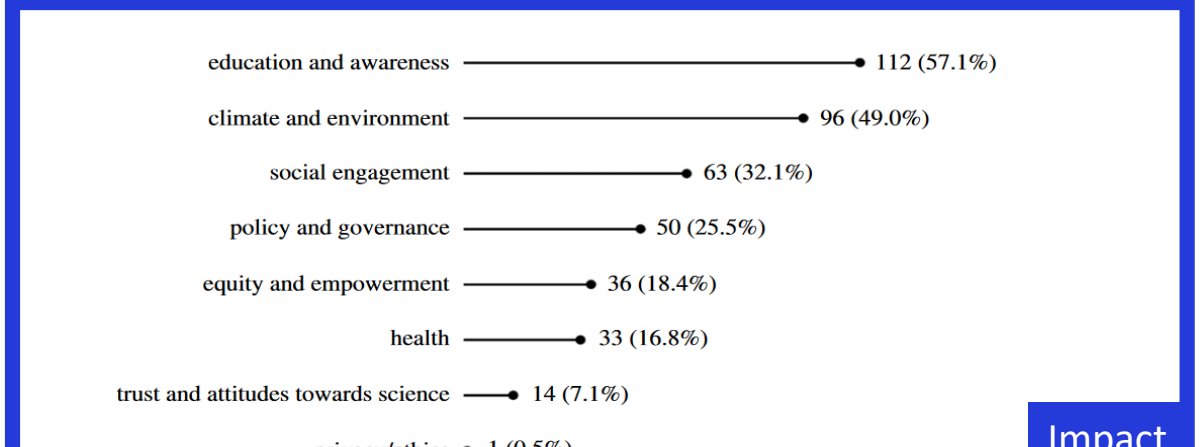


Impact

Societal Impact



Instruments



Impact

Existing Evidence

Economic Impact

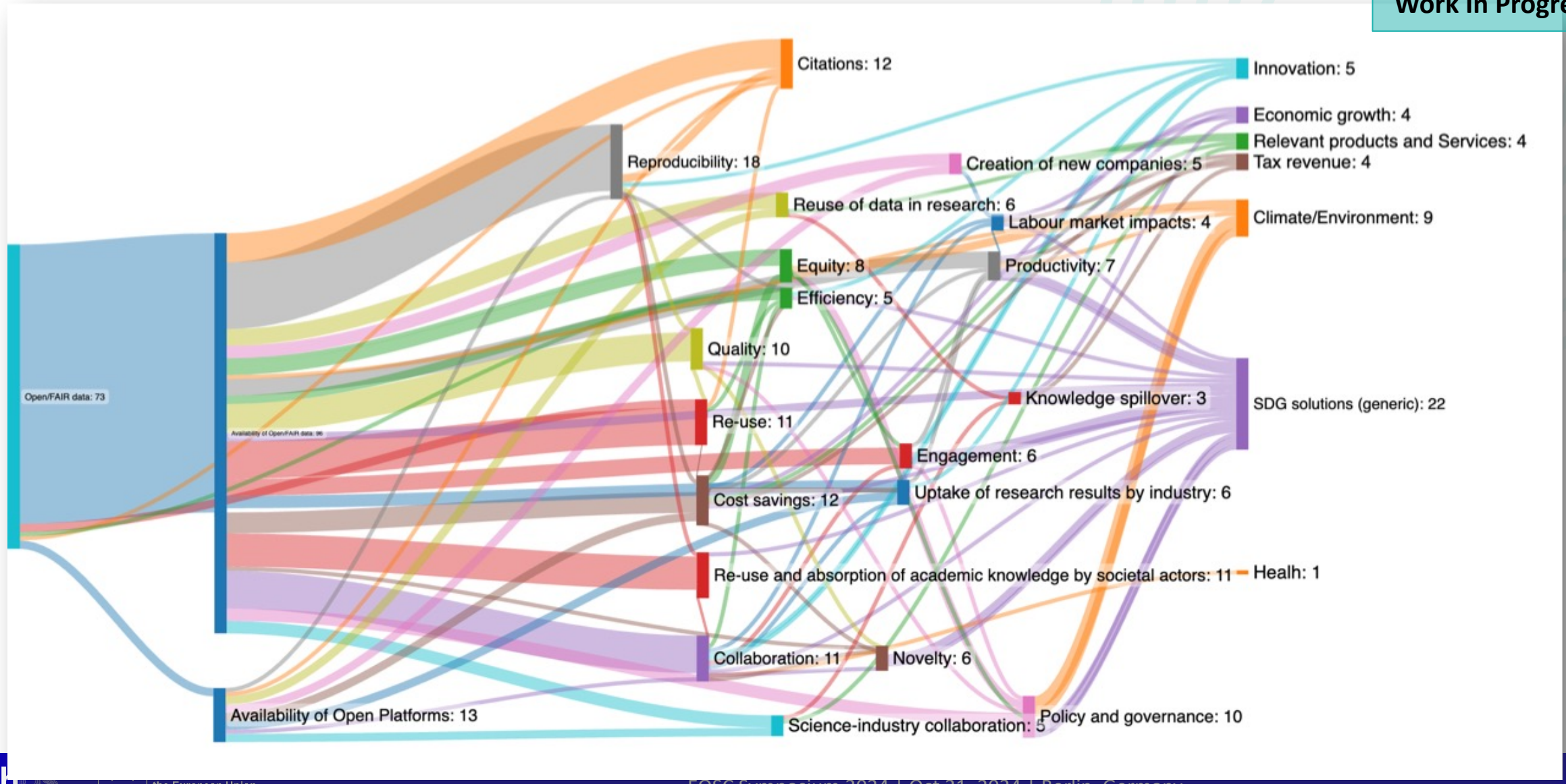
- Scarce company data
- Many theoretical papers on expected gains, but **few with real evidence**
- Most papers on Open Science, OA and Open Data, **few** on Citizen Science, Open Source or Open Code
- Most evidence comes from the **medical and biotech** sector

Challenges & Implications

- Lack of Standards: No clear definitions for OS impact
- Causality/Correlation: Hard to directly measure impact relationships
- Knowledge Gaps: Robust evidence missing in many areas, “streetlight effect”

Impact Pathways for Open Data

Work In Progress



Quantifying Impact - Indicators & Causality

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Indicators - State-of-the-Art

- **Academic**: Well-developed for traditional metrics, e.g., citations
- **Open Science**: Practices are well-covered. **Training** and **policies** need better indicators
- **Reproducibility**: Challenging to measu
  Some indicators under development - *collaboration with TIER2 project*
- **Societal & Economic Impact**: Less developed and harder to measure

Use of Proxies

Academic Impact

- Readership impact
- Citation Impact
- Collaboration intensity
- Diversity
- Extra-academic collaborati
- Interdisciplinary

Societal Impact

- Uptake in and impact on to societal issues
- Uptake by media
- Scientific literacy
- Uptake by policy makers

Economic Impact

- Science-industry collaborat
- Innovation output
- Socially relevant products a
- Economic growth of compa
- Labour market impact of O
- Cost savings

Reproducibility

- Introduction to Reproducibility
- Consistency in reported numbers
- Impact of Open Code in research
- Impact of Open Data in research
- Inclusion in systematic reviews or meta-analyses
- Level of replication
- Polarity of publications
- Reuse of code in research
- Reuse of data in research

Causality - Challenges

- **Complex Relationships:** Multiple factors make establishing direct causal links difficult

  Example of confounding factors: Increased collaboration after Open Data policies could also be due to more funding or training, complicating attribution

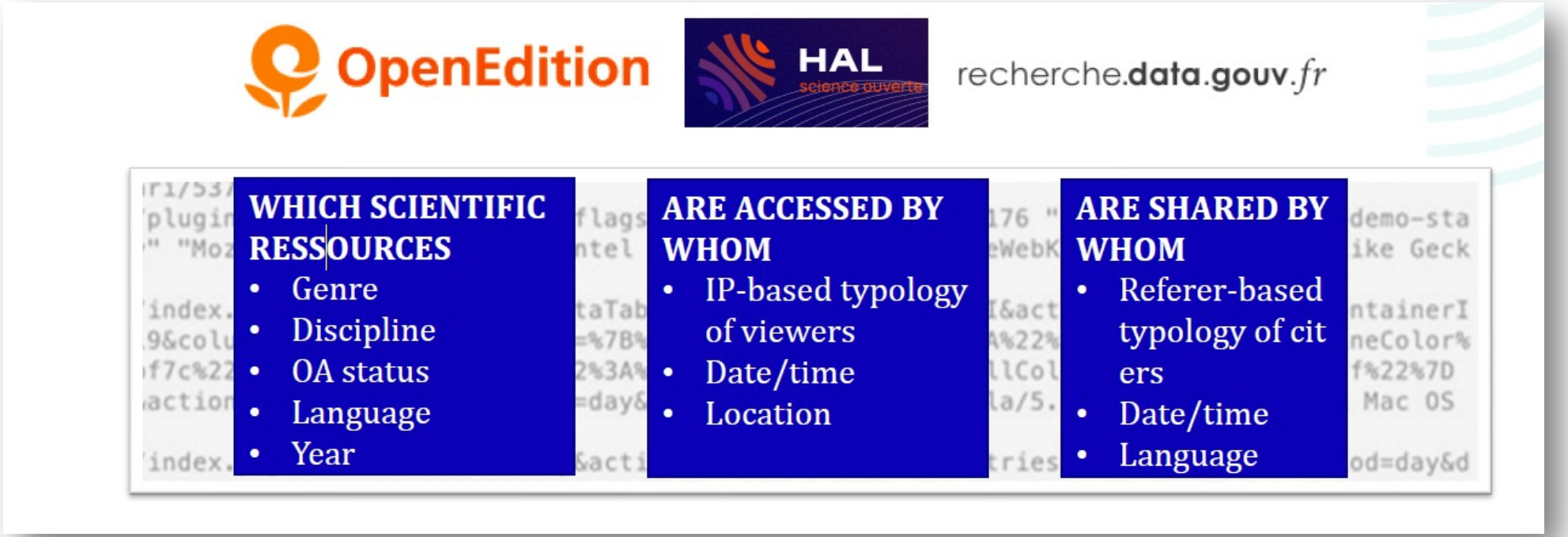
- **Causal Thinking in Interpretation:** Indicators alone are insufficient—interpreting their significance requires understanding **causal pathways**

Case Study –
France Open Science Infrastructure

Funded by the European Union

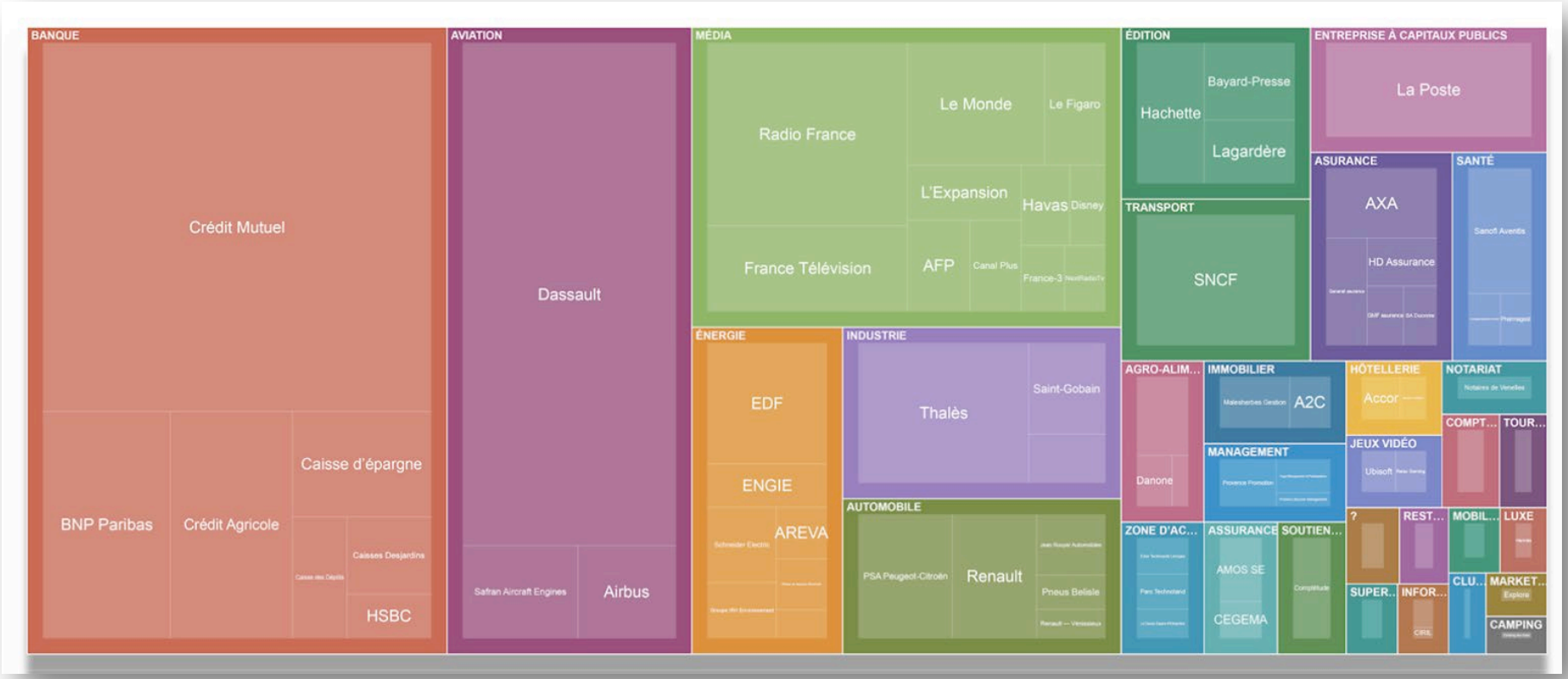
Impact of Open Science – Platform Access Logs

Simply put: **Who** accesses, **What**, from **Where**?



Uptake by Enterprises

Work In Progress



Color: Type of enterprise (bank, aviation, media, etc.)
Size: Number of times an OA article or dataset was accessed

Case Study –
Emerging AI trends in climate change

OpenAIRE Graph

Funded by the European Union

Emerging AI Topics in Climate Change – What

1. **Impact on Innovations:** Assess how **different OA routes influence** the development of AI methodologies and tools applied to climate research
2. **Gender Analysis:** Measure the effect of OA on gender equality, specifically on **women's representation as authors**

Emerging AI Topics in Climate Change - How

Harness the power of big data and deep learning

- **OpenAIRE Graph: 180 mi publication records** & **4 mi projects**
- **PATSTAT: 200 mi records from PATSTAT**

Benefits

- **Policy Impact:** Evidence-based, **novel AI-driven indicators**, informed decision-making
- **Causality Insights:** Causal links, **not just correlations**
- **Transparency & Reproducibility:** Based on **open data** — enabling transparency, validation, reuse

Emerging AI Topics in Climate Change - How

1. Establish **causality** by building **control groups** to make meaningful comparisons, accounting for OA routes, funding types, gender mandates, etc.
2. Enable **rich pathway analysis at every step**
3. Track **end-to-end research journey,** from funding to publication, from citations to technological innovation
4. Track **technological innovations** and **emerging interdisciplinary topics**: Fields of Science, Emerging Technologies for **Green and Digital**, Technology adoption
5. Assess **equality and diversity** within research fields via author gender representation

PathOS Moving Forward

- Develop “**causal indicators”** for inclusion in the PathOS Handbook
- Have **causality narratives for all case studies**
- Address **causality** in our frameworks
- Deliver **Cost Benefit Analysis methodology** for Open Science

Feedback & Dialogue

Join Us

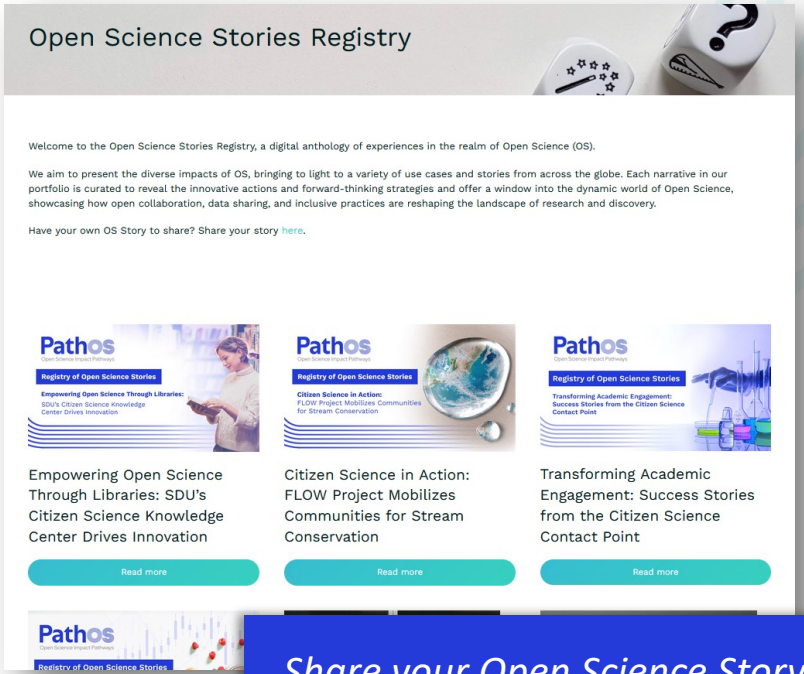
Training Programme

Coming in Q4/2024

A training programme for policy makers, policy officers and research administrators

Sign Up!

- Feedback form
- GitHub editing
- Validation Campaign (via email) – *Sign up!*



Share your Open Science Story

Thank you!

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https://pathos-project.eu/ →

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