Scoping Review

THE CONTRIBUTIONS OF OPEN SCIENCE TO RESEARCH CULTURE

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Scoping Review 'The Contributions of Open Science to Research Culture'

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The Contributions of Open Science to Research Culture

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1. Introduction

1.1. Report Focus

This report examines how open science practices contribute to research culture, drawing on a scoping review of academic and grey literature. While open science is widely promoted as a way to make research more transparent, inclusive, and collaborative, less is known about how it actually contributes to the values that underpin research culture.

Commissioned by Science Europe, this review explores the contributions and unintended consequences of open science in realising results that align with key research culture values such as equity, openness, integrity, care, collaboration, and autonomy, with the aim of informing future policy and research agendas.

1.2. Background

Research culture is increasingly recognised as a defining dimension of contemporary research and innovation systems (UKRI, 2024). The Royal Society describes it as *"the behaviours, values, expectations, attitudes and norms of our research communities. It influences researchers' career paths, and determines the way that research is conducted and communicated"* (Royal Society, n.d.).

Science Europe has itself articulated a series of position statements and frameworks on the subject, most recently in *A Vision and Framework for Research Culture 2025*. This document foregrounds values such as openness and transparency, care and collegiality, integrity and ethics, diversity, equity and inclusion, and collaboration. Crucially, it emphasises that institutions should be explicit about *"what is valued... why it is valued, and how it can be translated into policy and practice"* (Sapcariu et al., 2025, p. 11).

In these communications, 'research culture' signals a system-wide vision for reform. At the same time, it is useful to remember that there are also 'research cultures' in the plural: field- and discipline-specific ways of organising, producing, and validating knowledge, sometimes referred to as epistemic cultures in the academic literature (Knorr Cetina, 1999). The singular is helpful for building shared momentum around overarching principles, while the plural keeps in view the particularities of knowledge practices across settings and emphasises the autonomy of individuals, institutions, and nations in defining and enacting their cultures of research. Both registers are important in understanding how change takes place. These evolving meanings of research culture now increasingly shape how reform efforts like open science are understood, implemented, and evaluated across different contexts.

Open science encompasses a family of approaches that aim to enhance the accessibility, transparency and inclusivity of research processes and outputs, with the goal of enabling findings to be more widely shared, examined and developed by both the research community and the wider society (Klebel et al., 2025; Ross-Hellauer et al., 2022). It has been described as *"transparent and accessible knowledge that is shared and developed through collaborative networks"* (Vicente-Saez & Martinez-Fuentes, 2018) and by Science Europe as *"open and seamless collaboration between all actors involved in the research process, as well as open access to research outputs… [supporting] meaningful involvement of societal actors whenever relevant in the research process"* (Science Europe, 2022b, p. 3).

What began as narrower agendas around open access publishing and open data has since expanded into an umbrella term covering diverse reform trajectories. UNESCO's *Recommendation on Open Science* identifies twelve distinct dimensions, spanning from open access and open data to citizen science and open hardware (UNESCO, 2021). Science Europe's recent member survey adds further dimensions, including open research infrastructure, stakeholder engagement, open research methods, FAIR data and services, and leadership (Morris & Saenen, 2024). Full definitions of these terms are provided in Appendix B. This report focuses on these dimensions of open science, while exploring the extent to which, according to the research literature, they help to realise stated values of research culture articulated by Science Europe, in A Values Framework for the Organisation of Research (Science Europe, 2022a) and in expanded form in *A Vision & Framework for Research Cultures* (Sapcariu et al., 2025). This review also comes at a moment when the open science movement is maturing: early aspirations are increasingly accompanied by efforts to build a stronger evidence base, as seen in Science Europe's member survey (Morris & Saenen, 2024), the growing attention to national-level open science monitoring (OSMI, 2025), and the emergence of initiatives like Global Research Initiative on Open Science (GRIOS, 2025).

While the open science movement has been gaining momentum for over a decade, research culture is a more recent and still emerging policy object. It arises as a broader umbrella term to address the systemic conditions in which research is conducted, evaluated, and supported including, but not limited to, the openness of research practices. This evolving agenda seeks to complement existing open science reforms by focusing on the values, structures, and environments that shape how research is performed and experienced. Across policy statements, open science is consistently cast as a mechanism for addressing systemic challenges and inequities in research – expectations that are built into its very foundations as a reform movement. Over time, questions of values have also become more foregrounded in statements on open science (UNESCO, 2021) and by academic literature (Leonelli, 2023). If and how open science interventions are actually contributing to realisation of such values according to the research literature, is the overarching focus of this scoping review.

1.3. Research Culture as a Driver of Open Science

To date, most scholarly and policy debate has emphasised research culture transformation as a prerequisite for advancing open science. UK Research and Innovation's (UKRI) review, for instance, identifies research culture change as essential for embedding open science practices (Powell et al., 2024). Cultural conditions matter: in hyper-competitive environments, early data sharing is less likely; when career advancement depends on publishing in high-impact proprietary journals, incentives to publish in diamond open access outlets remain minimal.

Nosek's well-known cultural change pyramid situates cultural reform at the heart of normalising open science. It highlights five organisational levers: make it possible (infrastructure), make it easy (user experience), make it normative (communities), make it rewarding (incentives), and make it required (policy) (Nosek, 2019). In Europe, the Open Science Career Assessment Matrix (OS-CAM) and the Agreement on Reforming Research Assessment (CoARA, 2022) similarly identify assessment reform as critical to advancing open science, while cOAlition S has aligned its own Plan S with CoARA's principles to promote evaluation of outputs on intrinsic merit rather than journal prestige.

Taken together, these initiatives underscore how changes in culture and incentives are widely seen as the facilitators and drivers of open science adoption. They also reflect a growing recognition that meaningful change requires co-ordinated action across all levels of research systems, rather than isolated technical fixes.

1.4. The Knowledge Gap: Open Science's Contributions to Research Culture

By contrast, there is far less clarity on the reverse relationship: how open science practices themselves contribute to research culture. Much of the existing literature remains aspirational or forward-looking, rather than grounded in evidence. Yet this question is crucial, since open science interventions may generate both intended and unintended consequences depending on the context into which they are introduced.

The absence of robust evidence on these dynamics presents a challenge for stakeholders like policymakers, research funding and performing organisations, as well as researchers, who need to assess not only whether open science 'works' in some general sense, but how, under what conditions, and with what effects.

1.5. Aims of this Review

This review was commissioned by Science Europe. As set out in the invitation to tender (p. 2), the task is to:

> *"[C]onduct a scoping review of the academic literature on open science [...] covering all elements of open science identified in the survey, as well as the themes explored, and [serve] as the basis for a review of how open science impacts and contributes to research cultures. The link to research cultures should be made according to the effects and unintended consequences of open science policies and practices on the expectations, behaviours, and attitudes of the research community."*

Following this mandate, our study systematically scopes the peer-reviewed and grey literature to understand how open science practices influence cultures of research. Using PRISMA-ScR methodology (Tricco et al., 2018), we map existing evidence on:

- the mechanisms through which open science practices shape research culture,
- the contextual factors that enable or constrain these outcomes, and
- the knowledge gaps and directions for future research and action.

1.6. Composition of the Team

This project was a collaborative effort between Centre for Science and Technology Studies (CWTS) at Leiden University and the Open and Reproducible Research Group at Know Center Research GmbH.

The team was composed of three senior and three junior researchers with different training backgrounds (including sociology, psychology, political science, humanities, and computer science) and prior knowledge of the research area.

2. Methods

2.1. Overview

This scoping review followed the PRISMA methodological framework for systematic and scoping reviews (Page et al., 2021; Tricco et al., 2018). Searches were conducted in the Web of Science Core Collection and SciELo database to broaden geographic coverage. This was supplemented with snowballing of references via OpenAlex and targeted grey literature searches (e.g. policy reports). Full search strings are provided in Appendix D, with data and further supplemental information shared on Zenodo (Kormann et al., 2025).

All records were managed in Zotero in which duplicates were also removed. The SyRF platform (Bahor et al., 2021) was used to screen database search results. Title and abstract screening of database search results was conducted by two reviewers using a 'four-eye principle' i.e. both reviewers had to agree for a record to proceed to the next stage. Disagreements were resolved by a third reviewer. Full-text screening was then applied, followed by structured data extraction using a pre-defined charting form (Appendix C). The process for grey literature and snowball literature identification differed slightly (see details below).

In line with PRISMA, the work proceeded in five steps:

1. Identifying the research question
2. Identifying relevant studies
3. Selection of eligible studies
4. Charting the data
5. Collating and summarising the results

2.2. Identifying the Research Question

This review addressed the following questions:

1. What findings have been reported in the literature regarding the contributions of open science to research culture?
2. What kinds of mechanisms produce these contributions?
3. What contextual factors enable or constrain these contributions?
4. What knowledge gaps and indications for future research emerge from the findings of Questions 1–3?

2.3. Identifying Relevant Studies

Database searches in Web of Science and SciELO were conducted on 22 April 2025, with the snowball search conducted 26 June 2025 and grey literature searches taking place from 02 July 2025 to 17 July 2025, limited to English-language records. Search terms were derived from authoritative sources, including UNESCO's *Recommendation on Open Science*, Science Europe's member surveys, and the Royal Society's definition of research culture (see Appendix B for keywords and their definitions).

Searches were conducted in Web of Science, supplemented by:

- Snowballing references of included studies in OpenAlex using its API via R and previously included records as seeds for citation coupling.
- Targeted grey literature searches via Google[1] and relevant organisational websites (e.g. OECD, UNESCO, EC, EUA, Science Europe; search strings had to be split into parts for this).

The complete Boolean search strings for the database search are provided in Appendix D. The grey literature search process is detailed in the supplemental materials (Kormann et al., 2025).

2.4. Selection of Eligible Studies

Screening followed PRISMA 2020 guidelines and is summarised in a PRISMA flow diagram (see Figure 1). Records from the database search results were screened independently by two reviewers at title/abstract and full-text level. Disagreements were resolved by a third reviewer. The top 500 snowball search results were screened only once at title and abstract. Grey literature search results were immediately screened with only relevant literature being saved. Included literature was then moved forward into a joint full-text screening and data charting phase.

Inclusion criteria

- Peer-reviewed articles, preprints, or grey-literature reports from recognised stakeholders.
- Empirical studies (quantitative, qualitative, mixed) reporting on contributions of open science to research culture.
- Non-empirical works making a substantive theoretical contribution, grounded in empirical examples.
- Records in English (or with English translations).

Exclusion criteria

- Reviews, editorials, letters, book reviews.
- Studies reporting only expected (not observed) contributions of open science interventions.
- Normative advocacy pieces lacking empirical/theoretical contributions.

1. Google did not always yield exactly the same number of results when searches were repeated; however, it was useful to search sites that did not provide their own search interface.

- Studies reporting only on research culture's contributions to open science.
- Studies reporting attitudes, values, or prevalence of open science practices without analysis of contributions to research culture.

2.5. Charting the Data

Data were extracted from Zotero using a pre-specified charting form in Excel (Appendix C). Fields included bibliographic details, study design, relevance to dimensions of open science and research culture, research culture values, mechanisms, contextual factors, reported findings and outcomes. Full definitions of the terminology we use are in Appendix A.

2.6. Collating, Summarising, and Reporting the Results

Extracted data were compiled into a shared dataset. Themes were developed iteratively by the review team, informed by existing frameworks and refined through discussion and stakeholder feedback. This iterative framework development drew in particular on Science Europe's *A Values Framework for the Organisation of Research* (Science Europe, 2022a) and *Vision & Framework for Research Culture* (Sapcariu et al., 2025).

Results are presented both as a quantitative overview (produced using the R programming language; R Core Team, 2024) and as narrative presentation of key findings that summarises themes and patterns emerging from our analysis. The final section draws out wider implications of the studies' findings, addresses study limitations, and sets out priority gaps for future research.

2.7. Ethics, pre-registration, and data availability

As a literature review the study does not require ethical approval and none was sought. The study was pre-registered at the Open Science Foundation (protocol: https://osf.io/s79ct). The list of records analysed in this review in addition to further supplemental information and processing and analysis code is available on Zenodo: https://doi.org/10.5281/zenodo.17190288 (Kormann et al., 2025).

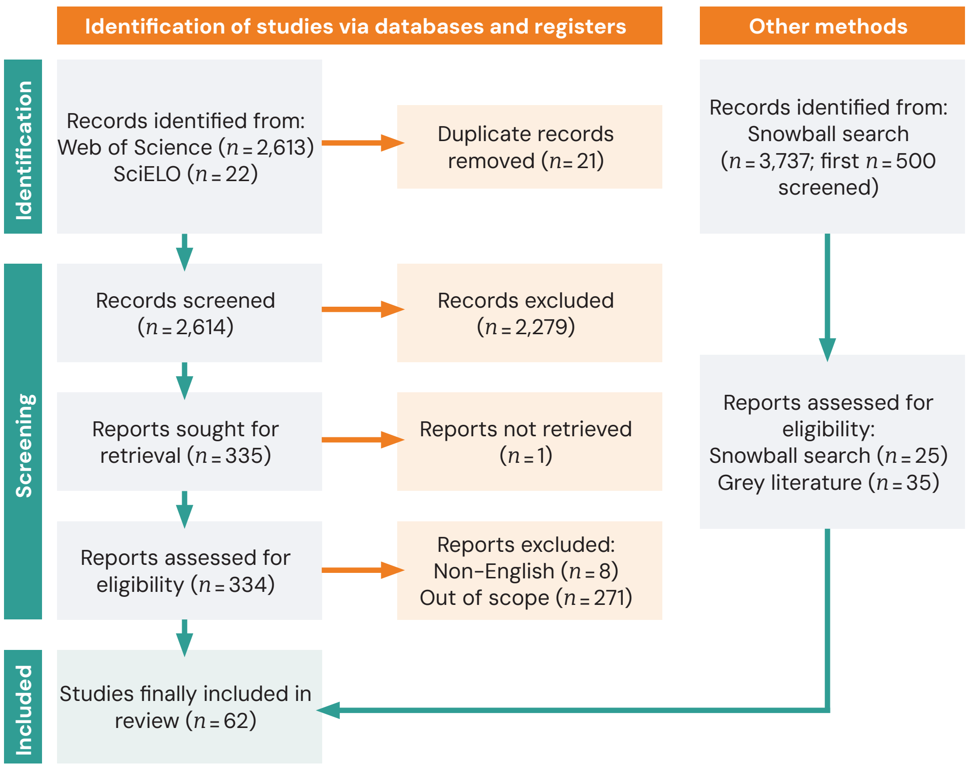
3. Results

3.1. Quantitative summary

The final sample of the review consists of 62 studies, which were included after a systematic database, grey literature and snowball search. The original database search yielded 2,614 unique records, which were initially screened by two reviewers. Interrater reliability was moderate (Cohen's $\kappa = .41$). Disagreements were resolved by a third reviewer and further discussed in joint meetings to continuously improve the screening process and learn more about the understudied phenomenon of research culture. From this first round, 55 studies were retained and served as seed records for the snowball search.

In this phase, 3,737 additional records were identified, of which the top 500 entries (not marked as reviews, editorials, letters, or datasets) were screened. From these, 25 studies were moved forward, with five included in the final dataset. In addition, 35 records from the grey literature were saved, of which two were ultimately included in the sample. This process resulted in a final sample of 62 studies (see Figure 1).

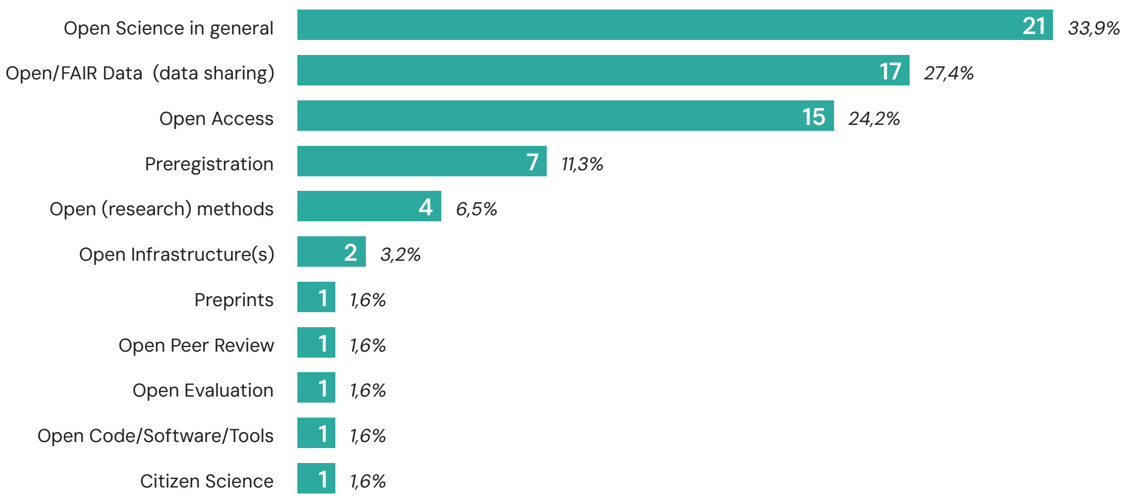
FIGURE 1 **PRISMA flow diagram of identified records, screening results and final included records**



Most of the included studies were journal articles (n=58; 93.5%), alongside a few other publication types. Most studies (90.3%, n=56) employed empirical approaches, whereas only 6 (9.7%) were theoretical. Most were published from 2020 onwards, with a median publication year of 2022 (the earliest dated back to 2010).

Looking at the thematic distribution of the records, based on Web of Science disciplinary categories, many contributions originated from library and information science (n=17; 27.4%), computer science (n=10; 16.1%), and psychology (n=9; 14.5%). Regarding open science practices, most studies addressed open science in general (n=21), open/FAIR data sharing (n=17), or open access (n= 15). Other categories such as preregistration (n=7), open methods (n=4) and open infrastructure (n=2) were less frequent. Preprints, open peer review, open evaluation, open code/software/tools, and citizen science were each represented only once (see Figure 2).

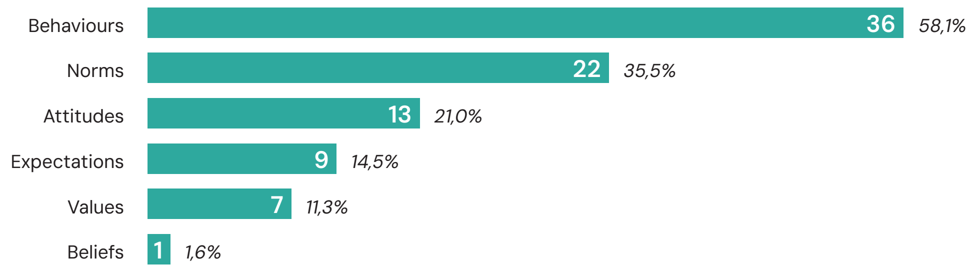
FIGURE 2 **Covered open science categories as coded for each record**



NOTE *One record can discuss multiple open science aspects and therefore be represented more than once; percentages are calculated based on the total number of included records.*

Based on the definition of research culture by the Royal Society Open Science, all records were assigned to which research culture aspects they address (see Figure 3). Multiple categories could be chosen for each record, with records having a mean of 1.42 assigned research culture aspects (min=1, max=4). The majority of records referred to behaviours (n=36) and norms (n = 22), while attitudes (n = 13), expectations (n = 9) and values (n = 7) were less common. Beliefs as an aspect of research culture were only coded to be addressed once.

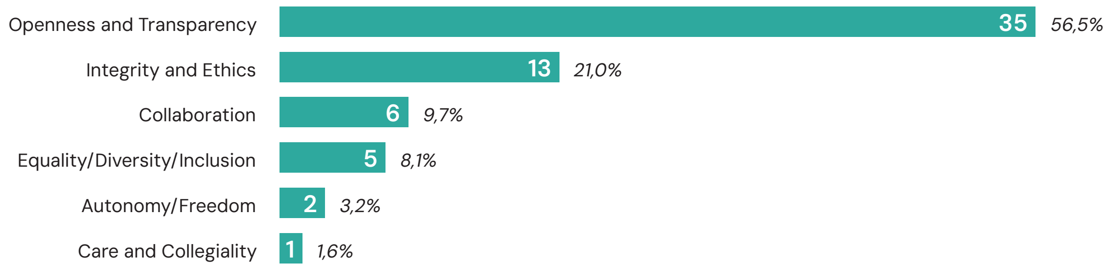
FIGURE 3 **Addressed research culture aspects as coded for each record**



NOTE *One record can discuss multiple research culture aspects and therefore be represented more than once; percentages are calculated based on the total number of included records.*

Regarding primary research culture values assigned to each record by our team (see Figure 4), a strong dominance of openness and transparency (*n* = 35) was evident, followed by integrity and ethics (*n* = 13). Other values appeared less often, including collaboration (*n* = 6), equality/diversity/inclusion (*n* = 5), autonomy/freedom (*n* = 2), and care and collegiality (*n* = 1). In some cases, secondary codes were assigned, most notably showing overlap between openness and integrity (with seven studies carrying both codes).

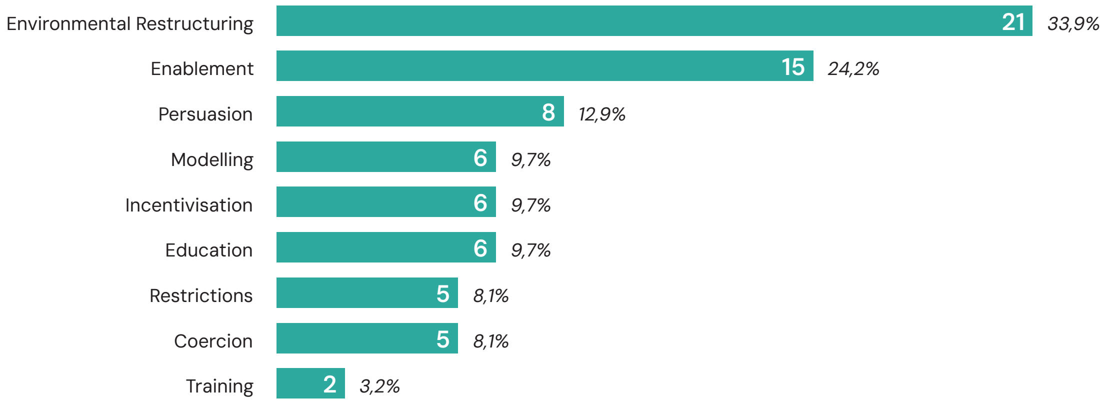
FIGURE 4 **Covered research culture values as coded for each record**



NOTE *This figure only represents the primary categories coded for each record that are also the basis of the narrative presentation of results; some records were also assigned secondary categories.*

Based on the Behaviour Change Wheel (BCW) framework (Michie et al., 2011, p. 7), codes were assigned to reflect through which mechanism(s) open science practices asserted their influence on research culture (see Figure 5). The most common mechanisms were environmental restructuring (*n* = 21) and enablement (*n* = 15), followed by persuasion (*n* = 8), modelling (*n* = 6), incentivisation (*n* = 6), and education (*n* = 6). Less frequent were restrictions (*n* = 5), coercion (*n* = 5), and training (*n* = 2).

FIGURE 5 **Behaviour Change Wheel mechanisms relevant for included records**



NOTE *One record can be assigned multiple BCW mechanisms and therefore be represented more than once; percentages are calculated based on the total number of included records.*

The assessment of outcome directions presented a mixed picture: 24 studies reported predominantly positive contributions of open science to research culture values, 27 mixed effects, while 6 documented null effects and 5 negative contributions (see Figure 6).

FIGURE 6 **Direction of outcomes presented by included records**

Overall, the records cover a wide range of open science practices, disciplinary contexts, and research culture values (see Appendix E for additional figures and tables). However, the focus of the sample is clearly shaped by recent, empirical studies that emphasise openness and transparency.

3.2. Thematic results

We provide the following summaries of key findings per research culture value set out by Science Europe in *A Values Framework for the Organisation of Research* (Science Europe, 2022a) and expanded on in *A Vision & Framework for Research Cultures* (Sapcariu et al., 2025).

Equality, Diversity and Inclusion

The values of Equality, Diversity and Inclusion (EDI) emphasise that all roles within the research community should be accessible and accommodating to all, regardless of sex and gender, ethnicity, disability, sexuality, class, faith, or other factors. It highlights the importance of supporting diversity across social categories, experiences, competencies, and merits of individuals, as well as across research inputs (methods, data, tools), outputs (communication and dissemination types), and organisational structures that govern the research process (Science Europe, 2022a).

Within the open science movement, this value has been taken up in different ways: sometimes with the promise that greater openness will create a more inclusive system, sometimes with warnings that without justice in the processes and practices of openness being upheld, other benefits of open science may be undermined (e.g. Leonelli, 2023; Bezuidenhout, 2025). Research has been quite varied in reporting positive and negative contributions of open science towards EDI.

Murphy et al. (2020) provide some encouraging evidence that literature on open science may be shifting authorship dynamics in ways favourable to women. Their bibliometric analysis shows that women were increasingly occupying high-status authorship positions (first or last author) in open science literature across 2010–2017, with odds of a woman in such a role rising by approximately 15% per year. This contrasts with trends in the parallel reproducibility literature, where women's representation in top authorship roles was declining. Their study also noted that the research publications in open science were more interconnected, with denser collaborative ties and more frequent use of communal and prosocial language used in studies, compared to the reproducibility literature. This suggests that the open science research space may foster an environment with somewhat stronger communal norms than in reproducibility research.

Wilson et al. (2022) examine whether open access publishing may help counter prevailing patterns of gender disadvantage in academic careers, which are often based on traditional publication indicators. Drawing on workforce and bibliometric data from universities in Australia and the UK, they examine correlations between open access publishing patterns and career outcomes for women researchers, including salary levels. Their analysis suggests that some forms of open access publishing, particularly gold open access, are associated with higher salaries for women, potentially reflecting improved visibility and citation impact. The authors also find that institutional context matters: in Australia, universities with higher proportions of women academics show slightly higher gold open access output, whereas the trend in the UK is marginally negative, possibly due to differences in national open access policies and funding mechanisms. Though the study does not establish causal effects, it draws on prior literature to suggest possible explanations for the observed correlations and contributes to ongoing conversations about how open access practices may influence gender equity in academic careers.

More negatively, Beigel (2024) argues that open science's egalitarian promise may remain unfulfilled if it is pursued without informational justice. Beigel stresses that openness cannot be reduced to simply making data or outputs available. If the conditions under which more available outputs and data reproduce epistemic hierarchies or 'subalternating' (subordinating) logics, then the research culture effects may still be negative, even if more activities and outputs are ostensibly 'open'. Beigel highlights cases where indigenous communities resisted the *"compulsive opening"* (p. 4) of their knowledge systems in the drafting of the UNESCO Recommendation on Open Science, leading to changes in its language. This example crystallises the point that openness pursued as an end in itself can be harmful if the means of inclusion are not just and respectful. Similarly, Cocq (2023) notes how indigenous researchers in Sápmi are using open digital tools in innovative ways, but warns that questions of ownership, authority, and control over digital data remain unsettled. Without clear answers on how to handle such sensitive material, the risks of exploitation or disrespectful involvement loom large. These accounts argue that openness is also about whose knowledge is legitimised, and on what terms.

In a different vein, Defazio et al. (2022) show that academics with broader professional commitments and parental responsibilities are more likely to withhold data and materials from previously published research. Here, the end goal of open science to generate communalism and collaboration collides with time and resource pressures, suggesting that when academics need to prioritise caring responsibilities, sharing data and materials is often deprioritised. The implication is that open science ideals may not fully align with lived conditions, as capacities to enact openness are unevenly distributed. In this example, EDI challenges are made visible in new ways and even reproduced, rather than 'fixed' by open science practices.

A common thread here is that open science can be an engine for more inclusive research cultures, but only if accompanied by the right social and organisational conditions. Without these, well-meaning attempts to improve social inequalities and injustices may fail to redress them or even unintentionally exacerbate them.

Openness and Transparency

Openness and transparency are clearly central values to the open science project, promising that research can be made more trustworthy, more efficient, and more collaborative if conducted in the open. The empirical evidence on whether such values are achieved through open science practices and policies is though somewhat mixed. There are a range of outcomes, positive, negative, mixed and null, which we now highlight.

Among the positive contributions reported, through experimental studies Schneider et al. (2022) report that open science badges can increase trust in scientists among the public, student teachers, and fellow researchers. The authors suggest though that this effect may also depend on credibility: badges assigned by journals with clear, transparent peer-review processes are trusted, while self-assigned badges are not. This would suggest openness signals in the form of badges can strengthen trust, particularly when backed up by existing authority and reputation. This raises questions about whether badges themselves are driving trust, or simply reinforcing trust already associated with recognised actors. In this sense, the intervention may have limited effectiveness in contexts where that prior credibility is lacking, with the overall efficacy of these interventions brought into question.

Vicente-Saez and colleagues (2020, 2021), in interview studies of sustainability science teams in Finland, describe how open access, open data, and stakeholder collaborations have extended traditional scientific norms. They argue that open access, open data, and collaborative practices are expanding Mertonian scientific norms of communalism, universalism, disinterestedness, and organised scepticism into new 'expansive norms' of participation and authorisation. Research teams that once worked in isolation now co-produce research with a wide range of stakeholders, from municipalities to NGOs. This is framed by the authors as a cultural shift in whom is authorised to contribute to knowledge production and how trust is conferred.

An evaluation of the Horizon 2020 programme shows that the open access requirements of the programme significantly increased the availability of open research outputs, with open access publications rising from 65% in 2014 to 82% in 2022, and datasets from 64 in 2015 to 1,694 in 2020 (Directorate-General for Research and Innovation (European Commission) et al., 2024). This illustrates how formal funding mandates can drive real behavioural change in publishing. Anagnostou et al. (2015) analyse data sharing in human paleogenetics, looking at both publications and a survey of researchers. They report very high sharing rates (97.6% of papers), substantially higher than in other areas of genetics. This, they argue, is not explained solely by compliance with journals or funders, but by awareness-raising, education, and persuasion mechanisms that have helped shift attitudes and beliefs. In this field, openness and transparency have been understood as ways to improve trust and the academic quality of research. Their conclusion is that epistemological motivations and awareness of the importance of openness can effectively complement policies and technical fixes.

Wallis et al. (2013) studied data sharing practices over a decade at the Center for Embedded Networked Sensing. They found researchers were generally willing to share data with colleagues outside their teams, as they were motivated by benefits such as avoiding duplication and creating new research opportunities. Sharing was done through requests, posting online, or repositories, though most data exchanges occurred between trusted colleagues. The authors use these insights to suggest openness of data sharing can promote and reinforce gift-economy norms in research, which is especially important if policies do not enforce it.

Turning to more negative reportage, Lilja (2020), surveying Finnish researchers, found that mandatory open science policies adopted by universities created feelings of alienation. While researchers supported openness in principle, the experience of top-down coercion led many to disengage. Policies aimed at increasing transparency therefore produced resistance when researchers felt excluded from the policymaking processes.

Peterson and Panofsky (2023) frame Metascience as a scientific-intellectual movement that emerged from open science and science of science, with a mission for methodological reform. It argues that Metascience often inadvertently reproduces unexamined norms, such as assuming that science is a unified field governed by universal methods and efficiency metrics. These assumptions conflict with insights from science studies, which emphasise the diversity and disunity of scientific practices. The authors caution that a dominant preference for quantitative, positivist, atheoretical approaches could result in overgeneralised reforms, counterproductive norm imposition across disciplines, and marginalisation of qualitative research. Attempts by such reforms to promote transparency may therefore create new blind spots and exclusions.

Focusing on mixed or null reporting, Reichman et al. (2021) surveyed research data management (RDM) practices across disciplines and reported that while data sharing is widely supported rhetorically, 42% of respondents said sharing data was not a priority. RDM was often treated as a technical exercise rather than a cultural or organisational one. Respondents highlighted how responsibilities for data curation were given to temporary staff, resulting in knowledge loss when contracts ended. In practice, openness policies added layers of technical management without solving underlying cultural barriers.

Cenci et al. (2024) surveyed established dental researchers in Brazil to examine perceptions of research integrity, open science, and evaluation practices in hiring, promotion, and grants. The study finds that while respondents rated non-traditional activities, like open science practices, integrity-related behaviours, and positive research climate, as more important for advancing science and creating social impact, traditional activities like publishing in high-impact journals remained far more important for career advancement. Incentives tied to open science and research integrity have therefore not shifted expectations about what matters for career development and progression, and by extension have not changed behaviours at the same pace. The main contextual barrier is the persistence of the journal impact factor and publication-based assessment criteria as dominant yardsticks. The authors note that most respondents had been in research for over a decade, suggesting they were socialised into this older system, which may help explain the limited effect of newer incentive schemes.

Stojanovski and Mofardin (2025) surveyed Croatian institutional publishers to map Diamond Open Access. They found that while Diamond Open Access journals embody openness in publishing, this does not translate into wider adoption of other open science practices such as open peer review or data sharing. In this case, openness in one domain did not spill over into others.

Even within the more positive cases, important limits and contextual nuances were visible. Some studies suggest that interventions like openness badges only build trust when backed by credible institutions (Schneider et al., 2022), and that data sharing often occurs within trusted circles without extending to broader reuse (Wallis et al., 2013). Others are based on single disciplines or localised settings (Vicente-Saez et al., 2021). As with other research culture values, whether openness and transparency are realised in practice depends on how open science practices are supported, perceived, and sustained across diverse contexts.

Integrity and Ethics

Upholding values of integrity and ethics denotes that everybody involved in research has a responsibility to make sure work is carried out in a reliable, honest, respectful, and accountable way. This applies not only to how research is conducted and funded, but also to how results and processes are shared with others. This can involve giving proper credit to all contributors, being clear about methods and standards, and ensuring that quality is checked at every stage (Science Europe, 2022a). How open science practices influence these principles of integrity and ethics is explored in a range of recent studies, which highlight both the opportunities and challenges for building a trustworthy research culture.

Several studies highlight progressive cultural shifts. Torka et al. (2023) show that replication studies have become somewhat more accepted in social psychology journals – while only 12% of author guidelines mentioned replication in 2015, this figure rose to 25% by 2022. Although most journals still made no reference, replication has moved from the margins to a partly legitimate element of publishing practice. Similar patterns emerge in organisational behaviour research, where Tenney et al. (2021) document a rise in preregistrations and open data between 2011 and 2019, even though most articles still did not adopt such practices. In biomedical research, Wallach et al. (2018) find that disclosure of funding and conflicts of interest has become common, while protocol sharing and replication remain rare but more visible than in previous decades. Brenninkmeijer et al. (2019) examine how openness and transparency are enacted in the experimental practices of psychologists, particularly through openness and transparency of reporting in methods sections. Drawing on interviews with 22 Dutch psychologists, the study finds strong normative support for open science, especially as a means of increasing transparency. However, researchers were often unclear about what open methods entail in practice, and their actual behaviours did not always align with open science ideals. The findings highlight a mixed picture, where endorsement of openness coexists with cultural frictions, uncertainty, and limited behavioural change in how methods are reported.

Other contributions point to the specific strengths and weaknesses of particular practices. Meskus et al. (2018) illustrate the potential of open peer review through the STAP stem-cell scandal, where blogs and platforms such as PubPeer enabled collective scrutiny and rapid exposure of data manipulation. These forms of 'accelerated virtual witnessing' demonstrate how openness can strengthen accountability, even if their impact is most visible in high-profile cases. Metcalfe et al. (2020) highlight how preregistration has become a norm in clinical trials, reinforced by journals and research funding organisations, and how bottom-up initiatives such as the UK Reproducibility Network help embed integrity in institutional practice.

A particular focus in several studies is open access. Tella (2020) shows how, under career and resource pressures, Nigerian researchers are especially vulnerable to predatory publishers, undermining trust in their work internationally. Zheng and Fu (2024) reveal that retraction rates are highest among Gold Open Access publications, though the meaning is ambiguous: this may reflect greater transparency and faster error detection in such journals, but could also point to structural weaknesses in some open access models.

Other work emphasises the ambivalence of open science more broadly. Zong et al. (2023) show that open science badges significantly increase data sharing but have limited impact on long-term scholarly reception, boosting social media attention but not citation rates. Hosseini et al. (2024) argue that open science initiatives that support research integrity can reinforce Mertonian norms such as communality and scepticism, but may also exacerbate inequalities by relying on third-party infrastructures and fuelling pressures for disclosure and surveillance. Finally, Maddi et al. (2024) find that open access publications are not more frequently subject to post-publication peer review than closed articles, suggesting that self-correction processes operate largely independently of access status.

Taken together, these studies indicate that open science can strengthen integrity and ethics by making replication more legitimate, preregistration more widespread, and collective accountability more visible. At the same time, they show that openness can also introduce new vulnerabilities, from predatory publishing to inequalities in infrastructure, and that cultural embedding is essential.

Care and Collegiality

This value highlights the responsibility of research communities and actors to foster safe, supportive, and respectful workplaces (Science Europe, 2022a). This assumes that research does not occur in isolation, but is embedded within a dynamic ecosystem that includes individuals (researchers, participants, administrators), institutions, material resources, and the wider natural and societal context.

Only one study in the scoping review with a primary emphasis on care and collegiality was found. Taking the example of ongoing lack of recognition for curatorial work within open science – which plays a vital role in enabling the reuse of data and materials, Pasquetto et al. (2025) argue such efforts often remain under-recognised. In many cases, curatorial activities are largely invisible: they are seldom featured in project mission statements or get clearly articulated elsewhere. Curatorial work only tends to be acknowledged when it is explicitly stated as part of a project's objectives. Even in projects that explain why they chose certain curatorial approaches, there is often little detail about who made those decisions or carried them out (Pasquetto et al., 2025).

This sparse literature suggests this is an under-explored area, and future research should consider how open science practices contribute to the relational dimensions of research systems. Care and collegiality, after all, are foundational conditions for good research cultures.

Collaboration

Collaboration is about the importance of working together in research. This includes co-operation between people with different skills within the same discipline, across disciplines, for improving research processes such as replication and reuse, and with partners from education, policy, industry, and society. Collaboration, when kept in balance with competition, is seen as a key condition for producing high-quality and trustworthy research (Science Europe, 2022a).

The analysed studies demonstrate that open science influences this value in different ways. Baker and Millerand (2024) illustrate, using the case of long-term ecological research (LTER), how community-driven data infrastructures can evolve over decades to enable co-operation. Their 'incremental growth model' shows that openness does not emerge through top-down initiatives, but through continuous negotiation and collective learning within research communities. A positive outcome of this process has been the strengthening of data literacy and a sense of responsibility within the community. At the same time, this form of collaboration remains resource-intensive and highly dependent on institutional support. Thus, cultural change in research emerges mostly when technical, social, and organisational factors are effectively aligned.

Lee et al. (2023) examine individual data sharing practices in psychology, using Ostrom's theory of collective action to explain how early participation can help establish shared norms and values. Their survey suggests that once data sharing becomes common practice, it reinforces a co-operative culture and increases the likelihood of continued engagement. At the same time, they note that motivations are mixed: while some view sharing as a contribution to collective knowledge, others see it as a strategy for enhancing professional reputation. Collaboration between science and society is most visible in the context of citizen science. L'Astorina et al. (2023) show that researchers with prior experience in such projects view citizen science more positively, by recognising its potential for enriching knowledge production through citizen collaboration. At the same time, concerns persist over a lack of institutional support, the fragility of long-term public engagement (since sustained collaboration often falters without stable resources and institutional commitment beyond project cycles) and insufficient recognition of contributions, especially from citizens. L'Astorina et al. further argue that these challenges are reinforced by incentive systems that continue to prioritise traditional research outputs over citizen engagement.

Finally, Felt et al. (2016) highlight the limitations of transdisciplinary sustainability research. While transdisciplinary funding instruments created new spaces for exchange, entrenched academic value systems, power asymmetries, and short-term project logics hindered the development of genuine collaboration. Although some partnerships did emerge through these funding instruments, a broader cultural shift remained stunted because other institutional frameworks of academia remained unchanged.

In sum, these studies demonstrate that open science can contribute to research culture by fostering collaboration. Positive effects arise through community-driven infrastructures, strengthened norms, institutional support, and societal engagement. Yet, the findings also show that these impacts can often be slow, context-dependent, and limited by existing conditions. Crucially, collaboration can only become a cultural norm when resources, recognition systems, and institutional structures actively support it.

Autonomy/Freedom

Autonomy and academic freedom are widely recognised as foundational to research as a form of organised enquiry. They are typically understood to refer to the capacity of researchers and institutions to pursue questions, methods, and topics based on professional expertise and judgement, with minimal external interference. It is often claimed that such autonomy is essential for advancing robust and innovative knowledge, and for enabling research to serve societal progress and sustainability. Realising this value depends not only on freedom from constraint but also on positive conditions, such as adequate funding, infrastructure, and recognition of diverse contributions and career paths. When supported appropriately, autonomy is assumed to foster creativity, inclusivity, and excellence across research domains. It also reflects a relationship of trust between research communities and the wider public, enabling scholarship to fulfil its broader social role (Science Europe, 2022a).

The open science movement has generally positioned itself as an enabler of autonomy and academic freedom. By promoting transparency, reproducibility, and collaboration, open science seeks to enhance trust and accountability without undermining researchers' freedom to define their own research questions, methods, and dissemination practices. Values such as open access, data sharing, and participatory research are meant to enhance trust and accountability without undermining the freedom to explore ideas independently.

The research literature on how open science practices affect academic freedom and autonomy in practice, however, is rather limited. The small amount of literature highlights both unintended effects of reforms and the practical obstacles they encounter.

On one hand, Collins et al. (2021) reveal that while open science innovations like pre-registration aim to enhance rigour and credibility, they may inadvertently constrain researchers' sense of autonomy and intellectual freedom. The study shows that highly structured publication practices designed to prevent selective reporting and questionable data use may reduce opportunities for exploratory inquiry, which many researchers find more enjoyable and motivating, and essential for creativity. By fostering a culture heavily focused on confirmatory research and prediction, open science practices like pre-registration may shift attention away from self-directed curiosity toward compliance with standardised protocols. This tension illustrates how efforts to improve transparency and reliability can unintentionally limit the freedom to pursue unanticipated questions, thereby challenging the balance between rigour and the autonomy necessary for scientific discovery and innovation.

While academic freedom often refers to researchers' individual freedom to pursue inquiry, it also includes the epistemic autonomy of institutions and national systems to set their own publishing norms and research agendas. Beigel (2021) explores how Latin America's longstanding open access ecosystem, built through public universities and regional repositories, has struggled to gain recognition within global research evaluation frameworks and indexing services. The author argues that a lack of interoperability between these regional infrastructures and dominant international systems results in the systematic devaluation of local open access outputs. Such outputs, in this context, cannot break the powers of 'global' infrastructures and metrics, with many Latin American researchers therefore ultimately incentivised to aim for internationally recognised outputs, at a cost of local autonomy in knowledge production.

These examples suggest that while open science can support academic freedom and autonomy, it may also work against these values if governed by rigid standards and infrastructures that fail to accommodate diverse regional, local or epistemic contexts

3.3. Change mechanisms in context

Based on categories from the BCW (Michie et al., 2011), the quantitative summary (Section 3.1) showed open science interventions were premised most often around two primary change mechanisms: environmental restructuring and enablement. Environmental restructuring refers to structural or systemic changes that alter the physical or social context in which researchers and other research actors operate (c.f. Michie et al., 2011). This may include the creation of new infrastructures , changing institutional processes, or modifying the surrounding environment in which research and research governance is performed. Enablement refers to increasing capabilities or reducing barriers, for example, where institutions lack the means to engage in desired practices.

Baker and Millerand (2024) illustrate how long-term ecological research communities built open data infrastructures over decades, thus reshaping scientific collaboration by embedding openness into the research environment (an illustration of effective environmental restructuring). By contrast, Beigel (2021) highlights how the lack of interoperability in Latin American open access infrastructure has led to under-valuation of regional research in evaluation systems – pointing to how absences and shortcomings in infrastructures have meant epistemic autonomy and visibility of certain research outputs is constrained. Beigel's narrative suggests an overall incomplete and partially ineffective environmental restructuring to date, whereas Baker and Millerand point to positive outcomes and impacts of restructuring, over a long duration.

Pasquetto et al. (2025) suggest that resourcing and recognising often invisible curatorial labour can *enable* professionalisation and thus support more equitable participation in open science practices. Similarly, Yuan et al. (2025) show how academic libraries and librarians act as key enablers for open science by offering tools, services, training and infrastructure, though they note these support structures are unevenly distributed and more widely available in wealthier settings.

A mechanism like coercion, although coded less frequently by the team, was associated with unintended consequences. Lilja (2020) documents how mandatory open science policies introduced by Finnish universities created feelings of alienation among researchers (despite in principle support for the ideas), as the top-down policies failed to engage with local values and provide adequate support to enable open practices. This suggests enforced changes and technical fixes alone are unlikely to catalyse culture change. Mandatory policies may in some circumstances play a role, but it is also inferred from the findings and from previous literature (e.g. Nosek, 2019) that multi-level changes to norms, incentives and resources, and compatibility with epistemic traditions, may also be required to support cultural change.

Further systematic research is needed to: a) investigate whether these reported claims are observed in other settings, b) understand better how less frequently observed mechanisms (e.g. persuasion, modelling, restriction and coercion) operate in practice and c) explore how combinations of mechanisms interact over time to influence the outcomes and impacts of open science practices and realisation of research culture values.

4. Discussion, Limitations, and Future Directions

This report is thought to be the first scoping review to examine systematically the literature on open science's contributions to research culture. In what follows, some of the more striking themes and patterns that have emerged across the studies reviewed are considered. The study's limitations are then discussed, before zooming out to reflect on the current state of research literature on open science's contributions to research culture, considering how far it has developed as an area of inquiry, where gaps remain, and where opportunities for a more concerted policy-relevant research agenda lie.

Major overarching insights from the scoping review of open science's contributions to research culture are:

- **Open science contributes to research culture – but unevenly**
  Open science has been shown to contribute benefits to research culture, but its benefits are not guaranteed and can sometimes lead to unintended consequences. In the abstract, few would disagree with espoused values like accessibility, transparency, equity, and collaboration. However, real-world implementation of open science practices should not be taken for granted as necessarily realising these values. For instance, material and infrastructural inequalities remain major limiting factors for realisation of such values, especially in the Global South (Beigel, 2024).

- **Ends do not always justify the means**
  The contributions of open science to positive research culture shifts depend not only on desired outcomes being realised, but also on whether the means of achieving them are just, inclusive, and workable (arguments also made in the work of Leonelli (2023)). For example, data sharing may actually reproduce or deepen inequities if not supported by adequate resourcing or attention to informational justice (Beigel, 2024; Cocq, 2023). Likewise, open science practices that improve accessibility of information while giving rise to new forms of invisible work or exploitation should not be uncritically celebrated.

- **Research culture improvements are often realised in settings with existing supportive institutional and social infrastructures**
  Positive effects are frequently reported but tend to be context-specific and not guaranteed to occur from a given open science intervention. For example, trust-enhancing credibility interventions were suggested by Schneider et al. (2022) to work best in contexts where credibility already existed, meaning in such circumstances open science badges may be reinforcing existing reputational authority rather than building new relations of trust in themselves. Furthermore, research communities already aligned to open science-related values will most likely enable stronger uptake of open science interventions, as opposed to communities

without prior awareness or dispositions towards such values (Vicente-Saez et al., 2021). Finally, specialist research cultures and incentives can strongly influence whether research culture outcomes are realised or not. Researchers will often consider whether open science interventions are disciplinarily meaningful to them and calculate whether investing in open science will harm their prospects, in often still traditional reward structures.

- **Mechanisms of change must align to contexts**
  Currently, it appears that there is a significant disconnect between institutionally mandated approaches to implementing open science practices and community-driven engagement with open science. The results of the recent survey conducted among Science Europe member organisations (Morris & Saenen, 2024) suggests that member organisations – predominantly research funding organisations – primarily drive their own open science strategies, with additional influence from national and international policies. However, research communities are rarely seen as key drivers. Main barriers to overcoming the disconnect include resource constraints, but also concerns about compatibility between open science practices and disciplinary career requirements, followed by practical difficulties such as challenges in relation to monitoring and legal questions. According to the literature, effective mechanisms to overcome the disconnect included awareness-raising and persuasion (Anagnostou et al., 2015) and visible credibility signals (Schneider et al., 2022). Coercion, by contrast, was in some instances reported to work (Directorate-General for Research and Innovation (European Commission) et al., 2024) but in some instances could be seen to backfire (Lilja, 2020). It appears that a layered approach to behaviour change is needed that combines coercion and mandates with efforts to align open science practices with reputational rewards systems within scientific communities. Following Nosek's (2019) pyramid of culture change for open science, mechanisms like open access and open methods mandates may play a role but also are more effective when preceded by efforts to create awareness, foster community buy-in, create infrastructure, and so on. This means that open science interventions are not technical fixes, but require a holistic approach to change that taps into and reinforces budding interest in open science practices within academic communities.

4.1. Limitations

Due to resource constraints, the formal literature review was limited to Web of Science-based searches (only partly compensated by reaching out beyond its Core Collection to include SciELO). At the time of the study, OpenAlex was deemed too underdeveloped for systematic review purposes (e.g. user experience did not match-up to the more mature commercial Web of Science tool). Opting for usability did mean the more extensive global coverage of the scholarly literature offered by OpenAlex was sacrificed. Due to resource constraints and the composition of the research team, only records in the English language were included. As such, it cannot be claimed that this is a completely comprehensive global scoping review on this topic.

The team struggled to achieve good inter-rater reliability during the screening of records. While the authors of the report take full responsibility for any limitations in the design and execution of the study, it is believed that this also reflects deeper challenges in operationalising 'research culture' as an analytical concept. As an international, interdisciplinary team, a range of assumptions were brought about what terms like culture mean, and how their associated values should be understood. Despite efforts to define such terms clearly in the study protocol, the team's experience raises questions about how easily they travel across contexts. As the term research culture continues to evolve, research teams working in this space may therefore need to accept a degree of interpretive flexibility or 'fuzziness'. Unlike analytic concepts in more mature research areas, it may be unrealistic to expect high inter-rater reliability when studying a concept that is still in flux, whose very strength lies in its ability to mobilise action across multiple different constituencies (and possibly mean slightly different things to each of them). As culture critic Raymond Williams famously observed, *"culture is one of the two or three most complicated words in the English language"* (1985, p. 87). Turning research culture into an object of systematic study, therefore is by its nature, a complex and often ambiguous undertaking.

The authors hope that this report, with both its strengths and limitations, will provide insights that can inspire and guide future investigations on this under-developed, but important, research agenda.

4.2. Reflections and Future Directions

With open science transitioning from an emerging reform agenda to an institutionalised policy agenda, there is growing recognition that credible, systematic evidence is essential to support its expanding ambitions and policy relevance (GRIOS, 2025; Morris & Saenen, 2024; OSMI, 2025). In this context, the extent to which open science is contributing to the realisation of research culture values is an important criterion on which to monitor and evaluate the effectiveness of its policies and programmes. Several observations can be made about the current state of research on open science's contributions to research culture, drawing partly on our results and partly on our team's reflections on our own review process.

The current literature is highly heterogeneous, spanning diverse practices, populations, and intervention mechanisms. This makes it difficult to draw generalisable conclusions or identify consistent patterns. Many of the features of a mature research area are currently lacking, such as shared research questions, methodological conventions, theoretical frameworks, or sustained scholarly dialogue. In light of this further support and funding for research is recommended, that is: (a) empirically grounded; (b) explicit about the intervention and its intended effects; (c) focused on specific populations; (d) attentive to the contextual mechanisms through which open science interventions succeed or fail to contribute towards shifts in research culture; (e) is sensitive to unintended consequences, recognising that values can conflict, meaning achieving some values via open science may come at the cost of overlooking or worsening prospects for achieving others; and, (f) attuned to studying longer time-horizons when empirically necessary (given culture change often takes a long time to unfold).

While this field can and should remain methodologically and theoretically pluralistic, the authors argue that its development depends on building a cumulative library of well-designed case studies. Although relevant literature in this review has been identified, few of the existing studies were explicitly designed to address the research agenda it is believed is now required. Going forward, a larger library of case studies needs to be generated to record and compare the pathways of open science contributions to research culture. As Flyvberg noted, areas of enquiry that lack a critical mass of exemplar cases cannot hope to evolve and progress (Flyvbjerg, 2006). Crucially, such a body of evidence should support not only academic analysis, but also knowledge sharing and mutual learning within the open science community and across stakeholder groups.

Additional research on open science's contributions to research culture is therefore needed to ensure that:

- Open science is treated more as a hypothesis within policy and reform movements, than self-evident truths.
- Future research should test these assumptions, rather than take them as given, through a programme of work that is:
  - Empirical and clearly theorised.
  - Context-sensitive and clear in reporting which mechanisms are being employed, how, and to what effects.
  - Focused on how open science interventions are implemented and experienced in specific case settings, with comparative case studies and studies encompassing longer timescales, especially valuable.
  - Sensitive to unintended consequences, hierarchies, and frictions between values.

Hopefully the findings and reflections can inform further research and policy action on open science's contributions to research culture.

5. References

AHAMMAD, N., BAHRI, F., & HUSAINI, H. (2024). Exploring the open-source impact on Bangladesh academic library service sustainability. *Journal of Information Communication & Ethics in Society*, *22*(4), 478–493. https://doi.org/10.1108/JICES-06-2024-0080

ANAGNOSTOU, P., CAPOCASA, M., MILIA, N., SANNA, E., BATTAGGIA, C., LUZI, D., & BISOL, G. (2015). When Data Sharing Gets Close to 100%: What Human Paleogenetics Can Teach the Open Science Movement. *PLOS One, 10*(3). https://doi.org/10.1371/journal.pone.0121409

BAHOR, Z., LIAO, J., CURRIE, G., AYDER, C., MACLEOD, M., MCCANN, S. K., BANNACH-BROWN, A., WEVER, K., SOLIMAN, N., WANG, Q., DORAN-CONSTANT, L., YOUNG, L., SENA, E. S., & SENA, C. (2021). Development and uptake of an online systematic review platform: The early years of the CAMARADES Systematic Review Facility (SyRF). *BMJ Open Science, 5*(1). https://doi.org/10.1136/bmjos-2020-100103

BAKER, K., & MILLERAND, F. (2024). The Incremental Growth of Data Infrastructure in Ecology (1980-2020). *Ecology and Evolution, 14*(12). https://doi.org/10.1002/ece3.70444

Barcelona Declaration on Open Research Information. (2024). https://barcelona-declaration.org/

BEIGEL, F. (2021). A multi-scale perspective for assessing publishing circuits in non-hegemonic countries. *Tapuya: Latin American Science Technology and Society, 4*(1). https://doi.org/10.1080/25729861.2020.1845923

BEIGEL, F. (2024). Opening the Social Sciences: Questioning Eurocentrism and Implementing Contextualized Open Science. *Global Perspectives, 5*(1). https://doi.org/10.1525/gp.2023.91203

BEZUIDENHOUT, L. (2025). Critically Unpacking the Concept of Equity for Open Science. *Social Epistemology*, 1–18. https://doi.org/10.1080/02691728.2025.2475460

BRENNINKMEIJER, J., DERKSEN, M., & RIETZSCHEL, E. (2019). Informal Laboratory Practices in Psychology. *Collabra: Psychology, 5*(1). https://doi.org/10.1525/collabra.221

CENCI, J., FRANCO, M. C., PEREIRA-CENCI, T., CORREA, M. B., HELAL, L., MOHER, D., BOUTER, L., HUYSMANS, M. C., & CENCI, M. S. (2024). Perceptions of research integrity and open science practices: A survey of Brazilian dental researchers. *Brazilian Oral Research*, 38, e135–e135. https://doi.org/10.1590/1807-3107bor-2024.vol38.0135

CoARA. (2022). *Agreement on Reforming Research Assessment.* https://coara.org/wp-content/uploads/2022/09/2022_07_19_rra_agreement_final.pdf

COCQ, C. (2023). Open science in Sámi research: Researchers' dilemmas. *Frontiers in Research Metrics and Analytics, 8*. https://doi.org/10.3389/frma.2023.1095169

COLLINS, H., WHILLANS, A., & JOHN, L. (2021). Joy and rigor in behavioral science. *Organizational Behavior and Human Decision Processes, 164*, 179–191. https://doi.org/10.1016/j.obhdp.2021.03.002

DALKIN, S. M., GREENHALGH, J., JONES, D., CUNNINGHAM, B., & LHUSSIER, M. (2015). What's in a mechanism? Development of a key concept in realist evaluation. *Implementation Science, 10*(1), 49. https://doi.org/10.1186/s13012-015-0237-x

DEFAZIO, D., KOLYMPIRIS, C., PERKMANN, M., & SALTER, A. (2022). Busy academics share less: The impact of professional and family roles on academic withholding behaviour. *Studies in Higher Education, 47*(4), 731–750. https://doi.org/10.1080/03075079.2020.1793931

DIRECTORATE-GENERAL FOR RESEARCH AND INNOVATION (EUROPEAN COMMISSION), PPMI, IDEA, & UNU-MERIT. (2024). *Evaluation study on excellent science in the European framework programmes for research and innovation: Final report phase 2: supporting the interim evaluation of Horizon Europe.* Publications Office. https://data.europa.eu/doi/10.2777/2295765

ENGLISH, P. B., RICHARDSON, M. J., & GARZÓN-GALVIS, C. (2018). From Crowdsourcing to Extreme Citizen Science: Participatory Research for Environmental Health. *Annual Review of Public Health, 39*(1), 335–350. https://doi.org/10.1146/annurev-publhealth-040617-013702

EUROPEAN COMMISSION. (N.D.). *Open Science*. https://research-and-innovation.ec.europa.eu/strategy/strategy-research-and-innovation/our-digital-future/open-science_en#:~:text=Events-,The%20EU%27s%20open%20science%20policy,developing%20the%20enablers%20for%20it.

FELT, U., IGELSBÖCK, J., SCHIKOWITZ, A., & VÖLKER, T. (2016). Transdisciplinary Sustainability Research in Practice: Between Imaginaries of Collective Experimentation and Entrenched Academic Value Orders. *Science Technology & Human Values, 41*(4), 732–761. https://doi.org/10.1177/0162243915626989

FLYVBJERG, B. (2006). Five Misunderstandings About Case-Study Research. *Qualitative Inquiry, 12*(2), 219–245. https://doi.org/10.1177/1077800405284363

GRIOS. (2025). *Towards Evidence-Based Open Science Policies: An Initiative to Advance Meta-Research on Open Science*. https://www.grios.org/

HOSSEINI, M., HIDALGO, E., HORBACH, S., GÜTTINGER, S., & PENDERS, B. (2024). Messing with Merton: The intersection between open science practices and Mertonian values. *Accountability in Research-Ethics Integrity and Policy, 31*(5), 428–455. https://doi.org/10.1080/08989621.2022.2141625

KLEBEL, T., TRAAG, V., GRYPARI, I., STOY, L., & ROSS-HELLAUER, T. (2025). The academic impact of Open Science: A scoping review. *Royal Society Open Science, 12*(3), 241248. https://doi.org/10.1098/rsos.241248

KNORR CETINA, K. (1999). *Epistemic Cultures: How the Sciences Make Knowledge*. Harvard University Press.

KORMANN, E., MARANGONI, A., LEE, T., ROSS-HELLAUER, T., KALTENBRUNNER, W., & RUSHFORTH, A. (2025). *Data, supplemental information and code for 'The contributions of open science to research culture – A scoping review'* (Version v1.0) [Dataset]. Zenodo. https://doi.org/10.5281/ZENODO.17190288

L'ASTORINA, A., DAVIS, C., PUGNETTI, A., CAMPANARO, A., OGGIONI, A., & BERGAMI, C. (2023). Scientists' attitudes about citizen science at Long-Term Ecological Research (LTER) sites. *Frontiers in Environmental Science, 11*. https://doi.org/10.3389/fenvs.2023.1130022

LEE, T., JUNG, M., & KIM, Y. (2023). Predicting psychologists' approach to academic reciprocity and data sharing with a theory of collective action. *Electronic Library, 41*(2/3), 223–241. https://doi.org/10.1108/EL-10-2022-0232

LEONELLI, S. (2023). *Philosophy of open science*. Cambridge University Press.

LILJA, E. (2020). Threat of policy alienation: Exploring the implementation of Open Science policy in research practice. *Science and Public Policy, 47*(6), 803–817. https://doi.org/10.1093/scipol/scaa044

MADDI, A., MONNEAU, E., GUASPARE-CARTRON, C., GARGIULO, F., & DUBOIS, M. (2024). Streetlight effect in PubPeer comments: Are Open Access publications more scrutinized? *Scientometrics, 129*(7), 4231–4247. https://doi.org/10.1007/s11192-024-05053-9

MESKUS, M., MARELLI, L., & D'AGOSTINO, G. (2018). Research Misconduct in the Age of Open Science: The Case of STAP Stem Cells. *Science as Culture, 27*(1), 1–23. https://doi.org/10.1080/09505431.2017.1316975

METCALFE, J. ET. AL. (2020, JUNE). Research integrity: A landscape study.

MICHIE, S., VAN STRALEN, M. M., & WEST, R. (2011). The behaviour change wheel: A new method for characterising and designing behaviour change interventions. *Implementation Science, 6*(1), 42. https://doi.org/10.1186/1748-5908-6-42

MORRIS, J., & SAENEN, B. (2024). *Strategic Approaches to, and Research Assessment of, Open Science*. Science Europe. https://doi.org/10.5281/zenodo.13961123

MURPHY, M., MEJIA, A., MEJIA, J., YAN, X., CHERYAN, S., DASGUPTA, N., DESTIN, M., FRYBERG, S., GARCIA, J., HAINES, E., HARACKIEWICZ, J., LEDGERWOOD, A., MOSS-RACUSIN, C., PARK, L., PERRY, S., RATLIFF, K., RATTAN, A., SANCHEZ, D., SAVANI, K., … PESTILLI, F. (2020). Open science, communal culture, and women's participation in the movement to improve science. *Proceedings of the National Academy of Sciences of the United States of*

America, 117(39), 24154–24164. https://doi.org/10.1073/pnas.1921320117

NOSEK, B. (2019). *Strategy for Culture Change*. https://www.cos.io/blog/strategy-for-culture-change

OSMI. (2025). *Open Science Monitoring Initiative*. https://open-science-monitoring.org/

PAGE, M. J., MCKENZIE, J. E., BOSSUYT, P. M., BOUTRON, I., HOFFMANN, T. C., MULROW, C. D., SHAMSEER, L., TETZLAFF, J. M., AKL, E. A., BRENNAN, S. E., CHOU, R., GLANVILLE, J., GRIMSHAW, J. M., HRÓBJARTSSON, A., LALU, M. M., LI, T., LODER, E. W., MAYO-WILSON, E., MCDONALD, S., … MOHER, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ, 372*, n71. https://doi.org/10.1136/bmj.n71

PASQUETTO, I., ABDU, A., & CHTENA, N. (2025). Essential work, invisible workers: The role of digital curation in COVID-19 Open Science. *Journal of the Association for Information Science and Technology, 76*(4), 703–717. https://doi.org/10.1002/asi.24965

PAWSON, R., & TILLEY, N. (1997). *Realistic Evaluation*. Sage.

PETERSON, D., & PANOFSKY, A. (2023). Metascience as a Scientific Social Movement. *Minerva, 61*(2), 147–174. https://doi.org/10.1007/s11024-023-09490-3

POWELL, J., BRITTON-DEWRY, E., PRINGLE, Y., METCALFE, J., JACOBS, N., EAST, K., GREY, L., & WOOLLETT, G. (2024). *Research culture initiatives in the UK*. https://www.ukri.org/publications/research-initiatives-in-the-uk-report/research-culture-initiatives-in-the-uk-report/

R CORE TEAM. (2024). *R: A Language and Environment for Statistical Computing*. R Foundation for Statistical Computing. https://www.R-project.org/

REICHMANN, S., KLEBEL, T., HASANI-MAVRIQI, I., & ROSS-HELLAUER, T. (2021). Between administration and research: Understanding data management practices in an institutional context. *Journal of the Association for Information Science and Technology, 72*(11), 1415–1431. https://doi.org/10.1002/asi.24492

ROSS-HELLAUER, T., & HORBACH, S. P. J. M. (2024). Additional experiments required: A scoping review of recent evidence on key aspects of Open Peer Review. *Research Evaluation, 33*, rvae004. https://doi.org/10.1093/reseval/rvae004

ROSS-HELLAUER, T., REICHMANN, S., COLE, N. L., FESSL, A., KLEBEL, T., & PONTIKA, N. (2022). Dynamics of cumulative advantage and threats to equity in open science: A scoping review. *Royal Society Open Science, 9*(1), 211032. https://doi.org/10.1098/rsos.211032

ROYAL SOCIETY. (N.D.). *Research Culture*. Retrieved 5 June 2025, from https://royalsociety.org/news-resources/projects/research-culture/

SAPCARIU, S., ŠINKŪNIENĖ, J., & MORRIS, J. (2025). *A Vision & Framework for Research Cultures: Improving the Condition for Researchers, Research Ideas, and the Research Endeavour*. Science Europe. https://zenodo.org/records/15124386

SCHNEIDER, J., ROSMAN, T., KELAVA, A., & MERK, S. (2022). Do Open-Science Badges Increase Trust in Scientists Among Undergraduates, Scientists, and the Public? *Psychological Science, 33*(9), 1588–1604. https://doi.org/10.1177/09567976221097499

SCIENCE EUROPE. (2022a). *A Values Framework for the Organisation of Research*. https://doi.org/10.5281/zenodo.6637847

SCIENCE EUROPE. (2022b). *Direction Paper. Open Science As Part of a Well-Functioning Research System*. https://doi.org/10.5281/zenodo.7214936

STOJANOVSKI, J., & MOFARDIN, D. (2025). Diamond Open Access Landscape in Croatia: DIAMAS Survey Results. *Publications, 13*(1). https://doi.org/10.3390/publications13010013

TELLA, A. (2020). Nigerian Academics Patronizing Predatory Journals Implications for Scholarly Communication. *Journal of Scholarly Publishing, 51*(3), 182–196. https://doi.org/10.3138/jsp.51.3.02

TENNEY, E., COSTA, E., ALLARD, A., & VAZIRE, S. (2021). Open science and reform practices in organizational behavior research over time (2011 to 2019). *Organizational Behavior and Human Decision Processes, 162*, 218–223. https://doi.org/10.1016/j.obhdp.2020.10.015

TORKA, A.-K., MAZEI, J., & HÜFFMEIER, J. (2023). Are replications mainstream now? A comparison of support for replications expressed in the policies of social psychology journals in 2015 and 2022. *Social Psychological Bulletin, 18*, e9695. https://doi.org/10.32872/spb.9695

TRICCO, A. C., LILLIE, E., ZARIN, W., O'BRIEN, K. K., COLQUHOUN, H., LEVAC, D., MOHER, D., PETERS, M. D. J., HORSLEY, T., WEEKS, L., HEMPEL, S., AKL, E. A., CHANG, C., MCGOWAN, J., STEWART, L., HARTLING, L., ALDCROFT, A., WILSON, M. G., GARRITTY, C., … STRAUS, S. E. (2018). PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Annals of Internal Medicine, 169*(7), 467–473. https://doi.org/10.7326/M18-0850

UKRI. (2024, JANUARY 18). *Explainer: How UKRI is supporting research culture*. https://www.ukri.org/publications/explainer-research-culture/explainer-how-ukri-is-supporting-research-culture/

UNAIDS, & MERG. (2008). *Glossary Monitoring and Evaluation Terms.* https://www.unaids.org/sites/default/files/sub_landing/files/11_ME_Glossary_FinalWorkingDraft.pdf

UNESCO. (2021). *UNESCO Recommendation on Open Science*. UNESCO. https://doi.org/10.54677/MNMH8546

VICENTE-SAEZ, R., GUSTAFSSON, R., & MARTINEZ-FUENTES, C. (2021). Opening up science for a sustainable world: An expansive normative structure of open science in the digital era. *Science and Public Policy, 48*(6), 799–813. https://doi.org/10.1093/scipol/scab049

VICENTE-SAEZ, R., GUSTAFSSON, R., & VAN DEN BRANDE, L. (2020). The dawn of an open exploration era: Emergent principles and practices of open science and innovation of university research teams in a digital world. *Technological Forecasting and Social Change, 156*. https://doi.org/10.1016/j.techfore.2020.120037

VICENTE-SAEZ, R., & MARTINEZ-FUENTES, C. (2018). Open Science now: A systematic literature review for an integrated definition. *Journal of Business Research, 88*, 428–436. https://doi.org/10.1016/j.jbusres.2017.12.043

WALLACH, O., BOYACK, K., & IOANNIDIS, J. (2018). Reproducible research practices, transparency, and open access data in the biomedical literature, 2015–2017. *PLOS Biology, 16*(11). https://doi.org/10.1371/journal.pbio.2006930

WALLIS, J., ROLANDO, E., & BORGMAN, C. (2013). If We Share Data, Will Anyone Use Them? Data Sharing and Reuse in the Long Tail of Science and Technology. *PLOS One, 8*(7). https://doi.org/10.1371/journal.pone.0067332

WEISS, C. H. (1997). Theory-based evaluation: Past, present, and future. *New Directions for Evaluation, 1997*(76), 41–55. https://doi.org/10.1002/ev.1086

WILLIAMS, R. (1985). *Keywords: A vocabulary of culture and society* (Rev. ed). Oxford University Press.

WILSON, K., HUANG, C., MONTGOMERY, L., NEYLON, C., HANDCOCK, R., OZAYGEN, A., & ROELOFS, A. (2022). Changing the Academic Gender Narrative through Open Access. *Publications, 10*(3). https://doi.org/10.3390/publications10030022

YUAN, Y., IDAYA, A., NOORHIDAWATI, A., & WANG, G. (2025). Trends and changes in academic libraries' data management functions: A topic modeling analysis of job advertisements. *Journal of Academic Librarianship, 51*(2).

ZHENG, E., & FU, H. (2024). A comparative study on characteristics of retracted publications across different open access levels. *Journal of Data and Information Science, 9*(2), 22–40. https://doi.org/10.2478/jdis-2024-0010

ZONG, Q., HUANG, Z., & HUANG, J. (2023). Do open science badges work? Estimating the effects of open science badges on an article's social media attention and research impacts. *Scientometrics, 128*(6), 3627–3648. https://doi.org/10.1007/s11192-023-04720-7

Appendix A
Glossary of Screening and Charting Terms

TERM	DEFINITION
Intervention	A specific activity or a set of activities intended to promote or support open science in a target group in the research ecosystem (researchers, research communities, universities, funders, policymakers, infrastructure providers, publishers, the general public); e.g. introduction of a preregistration repository, funding programme to build open research information infrastructure, citizen science training courses for academics, or open access mandate.
Programme	An overarching (inter)national, regional, or local initiative designed to co-ordinate multiple open science interventions in response to shared concerns raised by the open science movement (e.g. lack of transparency, inequity, reproducibility, engagement in research). A programme generally includes several interventions and may cut across sectors, geographical areas, or scientific disciplines (e.g. Plan S, EOSC, Africa PID Alliance).
Output	The direct result or deliverables of an open science programme or intervention e.g. number of pre-registered studies, number of datasets deposited, more frequent contact between researchers and citizens.
Outcome	Short-, medium- or long-term result, change, result, or effect associated with the output of an open science intervention or programme, such as change in attitudes, beliefs, knowledge, behaviours, norms, values, capabilities. Outcomes can be intended or unintended and can occur at individual, institutional, and/or system-wide levels e.g. more frequent contact between researchers and citizens (output) is reported to lead to a change in culture among researchers regarding what a legitimate collaborator looks like (research culture changed); mandatory data sharing policy generates cynicism towards open science among researchers (research culture not changed); drop in significant treatment effects reporting affirms belief in importance of pre-registration policies among a community of clinical researchers.
Mechanism	What makes an intervention work (or expected to work) in particular contexts e.g. sanctions may deter non-compliance (the stick), rewards may incentivise participation (the carrot), data sharing may facilitate collaboration, information campaign may enhance awareness (sermon).
Contextual enablers or constraints	The conditions or environment in which an intervention is introduced, which enables or constrains whether a mechanism is activated; e.g. one study may report sanctions (mechanism) as working when researchers are aware of stiff penalties for non-compliance (enabling context), while another study may report sanctions failing to be enabled because researchers judged them to be weakly enforced (constraining context). Whether the mechanism's causal potential is sparked or not, depends on the context.

NOTE *Definitions for the terms intervention, programme, output, and evaluation were adapted from UNAIDS's Glossary Monitoring and Evaluating Terms (UNAIDS & MERG, 2008). Mechanism and contextual factors definitions were adapted from Pawson and Tilley (1997), Weiss (1997), and Dalkin et al. (2015).*

Appendix B
Open Science and Research Culture Keywords and Definitions

Open Science Terms

TERM	DEFINITION
Open science *(also open research, open scholarship)*	Per UNESCO (2021), "an inclusive construct that combines various movements and practices aiming to make multilingual scientific knowledge openly available, accessible and reusable for everyone, to increase scientific collaborations and sharing of information for the benefits of science and society, and to open the processes of scientific knowledge creation, evaluation and communication to societal actors beyond the traditional scientific community." Can be understood as an umbrella term for the following practices, all aiming in various ways to increase access, transparency and participation in research ecosystems.
Open access	We follow Suber (2012) and define open access literature as being research literature (articles, books, conference proceedings) that is "digital, online, free of charge, and free of most copyright and licensing restrictions." Open access can be achieved either via open access publishing ('gold open access'), where these criteria are fulfilled on publication, or author self-archiving of alternative versions in repositories ('green open access').
Preprints	Versions of scholarly or scientific papers that are shared publicly (usually via preprint servers or repositories) before they have been peer-reviewed or formally published in a journal.
Open/FAIR data *(also data sharing)*	We define open data per the Open Definition (Open Knowledge Foundation, n.d.): Data is open if anyone is free to access, use, modify, and share it — subject, at most, to measures that preserve provenance and openness. Open government data is not in scope. Since not all data can be shared fully openly, data that is Findable, Accessible, Interoperable, and Reusable (FAIR) is also within scope (Wilkinson et al., 2016).
Open (research) methods	Sharing of methods, protocols, materials, and other experimental elements, especially to enable the re-use and reproduction/replication of research.
Preregistration	Registration of a research study's hypotheses, methods, and analysis plan before data collection begins to increase transparency and reduce bias.
Open lab notebooks	Publicly accessible scientific records where researchers document and share their experiments, methods, data, and findings in real time or near-real time to promote transparency and collaboration.
Protocol sharing	Public sharing of detailed research procedures and methodologies to ensure reproducibility and enable other researchers to replicate or build upon the work.
Open code/software/ tools	Openly available research code, software, or tools. This entails code, software and tools which are specifically built and maintained for research purposes. Examples include software written to accompany specific analyses, statistical libraries/packages, or dedicated research software. General purpose open-source software is out of scope.
Open hardware	Per UNESCO (2021), "design specifications of a physical object which are licensed in such a way that said object can be studied, modified, created and distributed by anyone, providing as many people as possible with the ability to construct, remix and share their knowledge of hardware design and function."

TERM	DEFINITION
Open infrastructure(s)	Per UNESCO (2021), "shared research infrastructures (virtual or physical, including major scientific equipment or sets of instruments, knowledge-based resources such as collections, journals and open access publication platforms, repositories, archives and scientific data, current research information systems, open bibliometrics and scientometrics systems for assessing and analysing scientific domains, open computational and data manipulation service infrastructures that enable collaborative and multidisciplinary data analysis and digital infrastructures) that are needed to support open science and serve the needs of different communities."
Citizen science	Opens the research process itself to the broader public ('citizens'). Practices range from crowd-sourcing data collection to 'extreme citizen science', with public involvement into processes of problem definition, data analysis and interpretation, as well as dissemination (English et al., 2018). Citizen science is increasingly part of common definitions of open science (e.g. the EC's approach to open science (European Commission, n.d.)). It is an important step in making research open to wider audiences, by fostering engagement beyond consumption, and is thus included within our scope.
Open evaluation	Umbrella term for Open research information (alternative, open sources of metrics for quantitative evaluation of research and researchers) (Barcelona Declaration on Open Research Information, 2024), as well as Open peer review for transparent assessment of individual pieces of research (e.g., research manuscripts, grant proposals) (Ross-Hellauer & Horbach, 2024).

Not in scope

- **Open government data** is not in scope, as we here only include open science activities related to academic research.
- For this reason, we also exclude **open educational resources**, which although sometimes grouped under open science, relates mainly to education rather than research.
- **Open innovation**: Although sometimes identified with open science, open innovation is seen to refer primarily to research and development in the private sector, and hence out of scope of our study.

Research Culture Terms

TERM	DEFINITION
Behaviours	The actions and conduct of individuals within the research environment, including how they interact, collaborate, and approach their work.
Values	The core principles and beliefs that guide decision-making and priorities within the research community.
Expectations	The standards or assumptions about how researchers should perform, interact, and contribute to their field.
Attitudes	The mindsets or perspectives researchers hold toward their work, colleagues, and the research system as a whole.
Norms	The informal rules and shared understandings that shape accepted practices and social behaviour in research settings.

Appendix C
Data Charting Form

Indicative fields for data extraction

DATA CHART HEADING	DESCRIPTION
Author(s)	Name of author(s)
Date	Date article sourced
Title of study	Title of article or output
Publication year	Year article was published
Publication type	Journal, website, conference etc.
DOI/URL	Unique identifier
Study aims	Overview of the main objectives of the study
Study details and design *(if applicable)*	Type of study (empirical or theoretical). Notes on method used in study (whether quantitative or qualitative), which populations (discipline or institution type studied etc.) were targeted.
Relevance to which aspect of open science	Dimension of open science from UNESCO Recommendation/Science Europe survey. Drop-down list: open science in general, open access, Preprints, open/FAIR data (also data sharing), open methods (also open research methods), preregistration, open lab notebooks, protocol sharing, open code/software/tools, open hardware, open infrastructure(s), citizen science, open evaluation, open research information, open peer review
Relevance to which aspect of research culture	Dimension of Research Culture from Royal Society definition. Drop-down list: behaviours, values, expectations, attitudes, norms
Relevance to which research culture value	Value of Research Culture from Science Europe vision. Drop-down list: openness and transparency; autonomy/freedom; care and collegiality; collaboration; equality, diversity and inclusion; integrity and ethics (for each record one primary category was chosen, but other relevant categories coded as well)
Relevance to which mechanism	Intervention function according to the BCW framework: Education, Training, Persuasion, Modeling, Incentivisation, Coercion, Enablement, Environmental, Restructuring, Restriction
Study findings	Synthesised statement of the main study results and implications that contribute to answering the scoping review research question(s). If stated, include: type of study (e.g. qualitative, quantitative, mixed-method, theoretical etc.); geographical setting; population targeted by intervention (e.g. individual researchers, research community, research funders, human resources departments, entire research systems, citizens). Include any outputs and/or outcomes* reported. If none, please note this. * If you encounter the term 'outcome measures' reported in a document, this should always automatically be noted as an output.

DATA CHART HEADING	DESCRIPTION
Reported contextual facilitators and barriers to mechanisms being activated	Note any contextual factors which were found to enable or inhibit the activation of mechanisms. Examples include: • An incentive (mechanism) results in researchers publicly sharing data (output) because they trust that open data will be recognised by promotion panels (facilitating context). • A persuasion message (mechanism) fails to change behaviour in a research field (outcome) because it does not align with research quality standards (barrier context); • A senior researcher preprints their work to encourage others (mechanism = role model) and junior colleagues then to do the same (outcome) because the senior colleague is well-known and respected in the field (facilitating condition); • A training course on data sharing is offered by the university (mechanism) but research staff do not attend (outcome) because they are overworked and do not have time (barrier context); • A university builds an online platform (mechanism) for open lab notebooks that leads to rapid uptake and routinisation of this practice (outcome) because the platform is available and user-friendly (facilitating context)
Notes	Queries or observations about document for internal discussion by research team, including identification of methodological or analysis issues which may limit reliability of results reported.

Appendix D
Extended Search Strings

Boolean query strings

TS=("open science" OR "open research" OR "open scholarship" OR "open access" OR "open data" OR "preprint*" OR "pre-print*" OR "FAIR data" OR "data sharing" OR "open method*" OR "open research method*" OR "pre-registration" OR "pre-registration" OR "protocol sharing" OR "open lab notebook*" OR "open code" OR "open source software" OR "open tool*" OR "open hardware" OR "citizen science" OR "open education*" OR "open peer review" OR "open evaluation*" OR "open science policy" OR "open research information" OR "open infrastructure*")

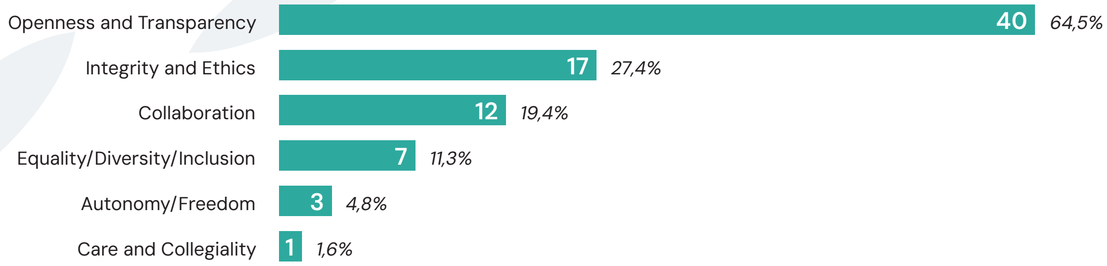
AND TS=((research OR scien* OR academi*) NEAR/1 ("culture" OR "environment" OR "climate" OR "integrity" OR "practice*" OR "norm*" OR "value*" OR "behavio*" OR "expectation*" OR "attitude*" OR "conduct" OR "ecosystem"))

AND TS=("effect*" OR "influence*" OR "impact*" OR "contribution*" OR "role*" OR "relationship*" OR "association*" OR "outcome*" OR "consequence*" OR "result*" OR "change*" OR "implication*" OR "improvement*" OR "shift*" OR "evolution" OR "affect*")

NOT TS=("open method of coordination" OR "This is an open access article" OR "Published by Elsevier B.V. Open access")

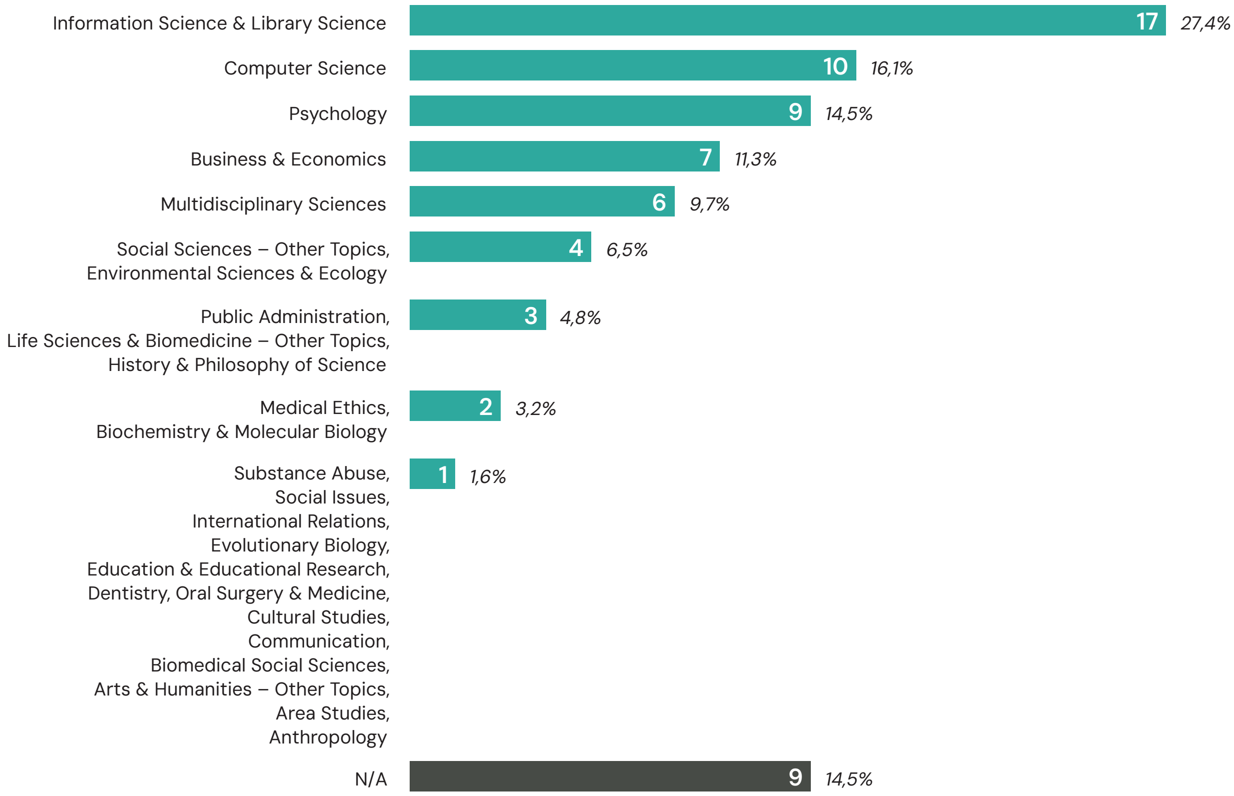
Appendix E
Additional Figures and Tables for Quantitative Analysis

FIGURE 7 **Covered research culture values for each record (including secondary categories)**



NOTE *While the results narrative is structured around primary research culture categories, records could be assigned multiple (secondary) categories which are fully reflected in this figure, meaning one record can be represented multiple times.*

FIGURE 8 **Full disciplines associated with the included records (retrieved from Web of Science)**



NOTE *Disciplines were retrieved based on the disciplines associated with the source journal in Web of Science (which was not available for some records, especially grey literature). Many source journals had multiple categories assigned to them, meaning that some records are represented multiple times within the figure. Percentages are calculated based on the total number of records.*

Table A Crosstab of coded open science practices and research culture aspects

Open Science Aspect	Behaviours	Attitudes	Expectations	Norms	Values	Beliefs
Citizen science	1 *(1.6%)*	–	–	–	–	–
Open access	10 *(16.1%)*	1 *(1.6%)*	1 *(1.6%)*	3 *(4.8%)*	1 *(1.6%)*	–
Open code/software/tools	–	–	–	2 *(3.2%)*	1 *(1.6%)*	–
Open evaluation	–	–	–	1 *(1.6%)*	–	–
Open infrastructure(s)	–	–	–	1 *(1.6%)*	1 *(1.6%)*	–
Open (research) methods	3 *(4.8%)*	–	–	2 *(3.2%)*	–	–
Open peer review	–	–	–	1 *(1.6%)*	–	–
Open science in general	14 *(22.6%)*	3 *(4.8%)*	4 *(6.5%)*	8 *(12.9%)*	3 *(4.8%)*	–
Open/FAIR data (data sharing)	8 *(12.9%)*	6 *(9.7%)*	3 *(4.8%)*	6 *(9.7%)*	2 *(3.2%)*	1 *(1.6%)*
Preprints	1 *(1.6%)*	–	–	–	–	–
Preregistration	2 *(3.2%)*	3 *(4.8%)*	2 *(3.2%)*	2 *(3.2%)*	–	–

NOTE *One record can be assigned multiple open science practices and/or research culture aspects and therefore be represented more than once; percentages are calculated based on the total number of included records.*

Table B Crosstab of coded open science practices and primary research culture values

Open Science Aspect	Collaboration	Autonomy/ Freedom	Equality/ Diversity/ Inclusion	Integrity & Ethics	Openness & Transparency	Care & Collegiality
Citizen science	1 *(1.6%)*	–	–	–	–	–
Open access	–	1 *(1.6%)*	1 *(1.6%)*	4 *(6.5%)*	9 *(14.5%)*	–
Open code/software/tools	1 *(1.6%)*	–	–	–	–	–
Open evaluation	–	–	–	–	1 *(1.6%)*	–
Open infrastructure(s)	–	1 *(1.6%)*	–	–	1 *(1.6%)*	–
Open (research) methods	–	–	–	3 *(4.8%)*	1 *(1.6%)*	–
Open peer review	–	–	–	1 *(1.6%)*	–	–
Open science in general	2 *(3.2%)*	–	3 *(4.8%)*	3 *(4.8%)*	13 *(21%)*	–
Open/FAIR data (data sharing)	2 *(3.2%)*	–	1 *(1.6%)*	1 *(1.6%)*	12 *(19.4%)*	1 *(1.6%)*
Preprints	–	–	–	–	1 *(1.6%)*	–
Preregistration	–	1 *(1.6%)*	–	1 *(1.6%)*	5 *(8.1%)*	–

NOTE *One record can be assigned multiple open science practices and therefore be represented more than once. For research culture values, only the primary coded category is considered; percentages are calculated based on the total number of included records.*

Table C Crosstab of coded Behaviour Change Wheel mechanisms and open science practices

BCW Mechanism	Open access	Open science in general	Open/FAIR data (data sharing)	Preregis-tration	Citizen science	Open code/ soft-ware/ tools	Open methods	Open peer review	Preprints	Open infrastruc-ture(s)	Open evaluation
Coercion	2 (3.2%)	1 (1.6%)	2 (3.2%)	2 (3.2%)	–	–	–	–	–	–	–
Education	–	2 (3.2%)	3 (4.8%)	–	1 (1.6%)	–	–	–	–	–	–
E—blement	2 (3.2%)	1 (1.6%)	6 (9.7%)	2 (3.2%)	–	1 (1.6%)	1 (1.6%)	1 (1.6%)	1 (1.6%)	–	–
Environmental Restructuring	6 (9.7%)	8 (12.9%)	5 (8.1%)	1 (1.6%)	–	–	3 (4.8%)	–	–	1 (1.6%)	–
Incentivisation	2 (3.2%)	2 (3.2%)	1 (1.6%)	2 (3.2%)	–	–	–	–	–	–	1 (1.6%)
Modelling	2 (3.2%)	3 (4.8%)	–	1 (1.6%)	–	–	–	–	–	1 (1.6%)	–
Persuasion	1 (1.6%)	4 (6.5%)	2 (3.2%)	1 (1.6%)	–	–	–	–	–	–	–
Restrictions	1 (1.6%)	2 (3.2%)	3 (4.8%)	–	–	–	–	–	–	–	–
Training	–	–	1 (1.6%)	–	1 (1.6%)	–	–	–	–	–	–

NOTE *One record can be assigned multiple BCW mechanisms and/or open science practices and therefore be represented more than once; percentages are calculated based on the total number of included records.*

Table D Crosstab of coded Behaviour Change Wheel mechanisms and research culture aspects

BCW Mechanism	Attitudes	Behaviours	Expectations	Norms	Beliefs	Values
Coercion	2 (3.2%)	3 (4.8%)	1 (1.6%)	1 (1.6%)	–	–
Education	2 (3.2%)	4 (6.5%)	–	2 (3.2%)	1 (1.6%)	2 (3.2%)
Enablement	5 (8.1%)	8 (12.9%)	2 (3.2%)	6 (9.7%)	–	1 (1.6%)
Environmental Restructuring	1 (1.6%)	10 (16.1%)	1 (1.6%)	8 (12.9%)	–	3 (4.8%)
Incentivisation	–	3 (4.8%)	2 (3.2%)	1 (1.6%)	–	1 (1.6%)
Modelling	1 (1.6%)	5 (8.1%)	–	2 (3.2%)	–	–
Persuasion	4 (6.5%)	6 (9.7%)	3 (4.8%)	4 (6.5%)	1 (1.6%)	1 (1.6%)
Restrictions	2 (3.2%)	5 (8.1%)	–	1 (1.6%)	–	–
Training	1 (1.6%)	2 (3.2%)	–	–	–	–

NOTE *One record can be assigned BCW mechanisms and/or research culture aspects and therefore be represented more than once; percentages are calculated based on the total number of included records.*

Table E Crosstab of coded Behaviour Change Wheel mechanisms and primary research culture values

BCW Mechanism	Autonomy/ Freedom	Integrity and Ethics	Openness and Transparency	Collaboration	Care and Collegiality	Equality/ Diversity/ Inclusion
Coercion	1 *(1.6%)*	2 *(3.2%)*	2 *(3.2%)*	–	–	–
Education	–	–	4 *(6.5%)*	2 *(3.2%)*	–	–
Enablement	–	3 *(4.8%)*	10 *(16.1%)*	1 *(1.6%)*	1 *(1.6%)*	–
Environmental Restructuring	1 *(1.6%)*	5 *(8.1%)*	10 *(16.1%)*	2 *(3.2%)*	–	3 *(4.8%)*
Incentivisation	–	1 *(1.6%)*	4 *(6.5%)*	1 *(1.6%)*	–	–
Modelling	–	1 *(1.6%)*	4 *(6.5%)*	–	–	1 *(1.6%)*
Persuasion	–	–	7 *(11.3%)*	–	–	1 *(1.6%)*
Restrictions	–	1 *(1.6%)*	4 *(6.5%)*	–	–	–
Training	–	–	1 *(1.6%)*	1 *(1.6%)*	–	–

NOTE *One record can be assigned multiple BCW mechanisms and therefore be represented more than once, for research culture values only the primary coded category is considered; percentages are calculated based on the total number of included records.*

Table F Crosstab of coded contribution and open science practices

Contribution	Open access	Open science general	Open/FAIR data (data sharing)	Preregistration	Open evaluation	Open infrastructure(s)	Citizen science	Open code/ software/ tools	Open (research) methods	Open peer review	Preprints
Mixed	7 *(11.3%)*	12 *(19.4%)*	8 *(12.9%)*	2 *(3.2%)*	–	–	–	–	–	–	–
Negative	2 *(3.2%)*	–	1 *(1.6%)*	2 *(3.2%)*	1 *(1.6%)*	1 *(1.6%)*	–	–	–	–	–
Null	3 *(4.8%)*	2 *(3.2%)*	1 *(1.6%)*	–	–	1 *(1.6%)*	–	–	–	–	–
Positive	3 *(4.8%)*	7 *(11.3%)*	7 *(11.3%)*	3 *(4.8%)*	–	–	1 *(1.6%)*	1 *(1.6%)*	4 *(6.5%)*	1 *(1.6%)*	1 *(1.6%)*

NOTE *One record can be assigned multiple open science practices and therefore be represented more than once; percentages are calculated based on the total number of included records.*

Table G Crosstab of coded contribution and research culture aspects

Contribution	Attitudes	Behaviours	Expectations	Norms	Values	Beliefs
Mixed	7 *(11.3%)*	19 *(30.6%)*	4 *(6.5%)*	9 *(14.5%)*	4 *(6.5%)*	–
Negative	1 *(1.6%)*	1 *(1.6%)*	–	2 *(3.2%)*	1 *(1.6%)*	–
Null	1 *(1.6%)*	2 *(3.2%)*	2 *(3.2%)*	1 *(1.6%)*	1 *(1.6%)*	–
Positive	4 *(6.5%)*	14 *(22.6%)*	3 *(4.8%)*	10 *(16.1%)*	1 *(1.6%)*	1 *(1.6%)*

NOTE *One record can be assigned multiple research culture aspects and therefore be represented more than once; percentages are calculated based on the total number of included records.*

Table H Crosstab of coded contribution and primary research culture values

Contribution	Collaboration	Equality, Diversity & Inclusion	Integrity & Ethics	Openness & Transparency	Autonomy & Freedom	Care & Collegiality
Mixed	2 *(3.2%)*	3 *(4.8%)*	6 *(9.7%)*	16 *(25.8%)*	–	–
Negative	–	–	1 *(1.6%)*	1 *(1.6%)*	2 *(3.2%)*	1 *(1.6%)*
Null	–	–	1 *(1.6%)*	5 *(8.1%)*	–	–
Positive	4 *(6.5%)*	2 *(3.2%)*	5 *(8.1%)*	13 *(21%)*	–	–

NOTE *For research culture values only the primary coded category is considered; percentages are calculated based on the total number of included records.*

Table I Crosstab of coded contribution and Behaviour Change Wheel mechanisms

Contribution	Coercion	Education	Enablement	Environmental Restructuring	Incentivisation	Modelling	Persuasion	Restrictions	Training
Mixed	3 *(4.8%)*	2 *(3.2%)*	4 *(6.5%)*	9 *(14.5%)*	2 *(3.2%)*	2 *(3.2%)*	3 *(4.8%)*	3 *(4.8%)*	1 *(1.6%)*
Negative	1 *(1.6%)*	–	1 *(1.6%)*	1 *(1.6%)*	2 *(3.2%)*	–	–	–	–
Null	–	1 *(1.6%)*	2 *(3.2%)*	2 *(3.2%)*	1 *(1.6%)*	1 *(1.6%)*	1 *(1.6%)*	–	–
Positive	1 *(1.6%)*	3 *(4.8%)*	8 *(12.9%)*	9 *(14.5%)*	1 *(1.6%)*	3 *(4.8%)*	4 *(6.5%)*	2 *(3.2%)*	1 *(1.6%)*

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