UK
Metascience
Unit

A Year in Metascience

The past, present and future of UK metascience

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The past, present and future of UK metascience

Data and analysis for the UK Metascience Unit (June 2025)[1]

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1. Context

This short report was commissioned by the UK Metascience Unit as a contribution to its ongoing analysis and shaping of UK capabilities and priorities in metascience. It is intended as a technical annex to its report 'A Year in Metascience', which is being published on 30 June 2025, alongside the Metascience 2025 conference, to be hosted in London by RoRI and UCL. All statistics presented here will be made openly available on publication as an interactive web tool for comparison and benchmarking of national systems and frameworks for metascience and related initiatives.[3]

2. What is metascience?

Metascience has deep roots and many branches. It is currently experiencing a fresh burst of growth, with new shoots appearing in many parts of the global research system.

The UK research community has been an important part of metascience's history and evolution. And thanks to the strategic focus and investment being mobilised by the UK Metascience Unit[5] – the first such initiative in the world to operate across central government and the national research funding agency – the UK is now well-positioned to become an influential testbed of metascience analysis, experimentation and innovation.[6]

> The science of science, like the history of history, is a second-order subject of first-order importance.
>
> Derek J. de Solla Price (1964)[4]

1. Wilsdon, J., Brasil, A., Waltman, L., & Steyn, B. (2025). The past, present and future of UK metascience: supplementary data and analysis for '*A Year in Metascience*'. UK Metascience Unit. June 2025. DOI: 10.6084/m9.figshare.29210066
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3. The online tool is available here: https://public.tableau.com/app/profile/andr.brasil8692/viz/ResearchonResearchLandscape/Story1
4. De Solla Price, D J (1964) "The Science of Science", Ch.14 in Goldsmith, M. & Mackay, A. *The Science of Science: Society in the Technological Age*. London: Souvenir Press
5. https://www.ukri.org/what-we-do/browse-our-areas-of-investment-and-support/uk-metascience-unit/
6. Wilsdon, J. (2023). Government adoption of metascience can make UK research work better and smarter. Wonkhe, 27 November 2023. https://wonkhe.com/blogs/the-government-discovers-metascience/

But what do we mean by 'metascience'? Definitions vary, and lines are blurred between metascience and other closely-related terms, including 'metaresearch', 'science of science' and 'research on research'. Each of these "buzzwords and fuzzwords"[7] has its own genealogy, context and networks, which space prevents us from unpacking in detail here.[8] Contrary to calls by some to sharpen the definitional distinctions between metascience and metaresearch,[9] our starting point is that these terms are – in their practical, everyday usage – increasingly employed as synonyms. What links them is a shared commitment to the application of robust methods to the analysis of research systems, cultures and decision-making – such that the simplest five-word definition of metascience would be "the science of science itself".

7. Cornwall, A. & Eade, D. (Eds.) (2010). Deconstructing Development Discourse: Buzzwords & Fuzzwords. Oxford: Oxfam.
8. For overviews of the origins and evolution of metascience, see: Peterson, D., Panofsky, A. (2023) Metascience as a Scientific Social Movement. Minerva 61, 147–174. https://doi.org/10.1007/s11024-023-09490-3; Ioannidis, JPA et al (2015) Meta-research: Evaluation and Improvement of Research Methods and Practices. PLoS Biol 13(10): e1002264. https://doi.org/10.1371/journal.pbio.1002264; Derrick, GE, Nuseibeh, N., Oancea, A. and Xu, X. (2024) 'Meta-research as discipline, field or spectrum' in *Handbook of Meta-Research*. (2024). Edward Elgar.
9. For example, in the introduction to their *Handbook of Meta-Research*, Derrick et al. suggest that "the term 'meta-research' comes without the full epistemological undertones of the term 'meta-science'...[and] encompasses the full spectrum of modes and types of scholarly inquiry." Derrick, G. E., Nuseibeh, N., Oancea, A. and Xu, X. (Eds., 2024) *Handbook of Meta-Research*. Edward Elgar, p.3

Flavours of metascience: five definitions

"Meta-research is an evolving scientific discipline that aims to evaluate and improve research practices. It includes thematic areas of methods, reporting, reproducibility, evaluation, and incentives (how to do, report, verify, correct, and reward science)."

John Ioannidis, et al (2015).
https://doi.org/10.1371/journal.pbio.1002264

"Many scholarly fields conduct descriptive research about the research process. Advocates and reformers have prescriptive ideas about how the research process might be improved. Policymakers, funders, publishers, and other stakeholders enact changes to the social and technical infrastructure of research. All have an interest in whether changes and reforms have their intended effects or unintended consequences that might accelerate or inhibit advancement, translation, and application of research. Together, these researchers and stakeholders are the research and development pipeline for improving the system and practice of research."

Centre for Open Science and RoRI (definition adopted for the Metascience 2025 conference)

"'Metascience' is a growing movement among academics, governments, private and philanthropic funders and research-performing institutions. They are all increasingly concerned with how to get the most out of the money society spends on research and development. Within the metascience community there are two characteristic groups: (1) Researchers using rigorous social scientific methods (for example, experiments and qualitative, or quantitative, data analysis) to study the practice of science itself.... ; (2) A community of practice united by an interest in designing, implementing, and evaluating innovative modes of science funding and delivery... The UK Metascience Unit's thesis is that these two groups acting together and in collaboration can improve our scientific ecosystem by understanding what works in research funding, policy and practice."

UK Metascience Unit (2025).

"Metascience is a scientific social movement that seeks to use quantification and experimentation to diagnose problems in research practice and improve efficiency. It draws together data scientists, experimental and statistical methodologists, and open science activists into a project with both intellectual and policy dimensions. Metascientists have been remarkably successful at winning grants, motivating news coverage, and changing policies at science agencies, journals, and universities."

David Peterson and Aaron Panofsky (2023) Metascience as a Scientific Social Movement. https://doi.org/10.1007/s11024-023-09490-3

"One conception of metascience is that it's about fine-tuning science, making incremental tweaks to social processes such as peer review or grant-making. But we conceive of metascience differently, believing radically different and far better social processes are possible, and that the metascience design space is vast and mostly unexplored."

Michael Nielsen and Kanjun Qiu (2022). https://scienceplusplus.org/metascience/

3. Our methods

To better understand how the metascience landscape in the UK and elsewhere has developed, we began with a detailed bibliometric analysis using the Dimensions database (www.dimensions.ai). The analysis used a Dimensions data dump made available to CWTS in July, 2024.

Rather than anchoring the study in a single formal definition of metascience, we set out to create a comprehensive delineation of the main research areas, communities, and disciplines that now constitute metascience (also described in other contexts as meta-research, science of science, or research on research.)

Our search strategy unfolded in two stages. First, we crafted queries that reflected different metascientific communities. The team reviewed existing literature and author keywords using standard systematic review procedures to identify appropriate terms. Second, we built queries that reflected priority topic areas within metascientific literatures.

An initial topic-modelling exercise — based on key publications on themes such as 'open science', 'reproducibility' and 'science/research policy'— yielded a candidate list of topics. These were added to, discarded, expanded, or merged. Both sets of queries underwent numerous tests and iterations by the project team – and external sense-checking with others – before we settled on our final search strings.

The search sought a holistic, high-level view of UK-authored or co-authored metascience literatures by combining textual queries and bibliometric techniques. Search queries were developed to target titles and abstracts in the Dimensions database, and to retrieve publications related to metascience disciplines or topics of interest. Affiliation metadata was then used to identify country-level authorship.

These bibliometric methods used were further supplemented by rolling analysis of government and funder literatures, media coverage and policy announcements over the past 12-18 months, intended to capture ongoing dynamics of change in the landscape (which may not yet be fully reflected in formal publications and citations).

This brief report highlights insights of greatest relevance to a UK system perspective, through a series of ten figures drawn from our analysis. In related publications, the RoRI and CWTS team will explore the broader global picture.

4. A potted history of metascience (1939–1999)

Metascience and its related terms have gained in currency and visibility over the past decade, propelled by methodological advances and alignment with top-down policy priorities and bottom-up movements in global science. But the questions that metascience seeks to address are far from new. Rich seams of theoretical and empirical work on these questions flow through several disciplines and subdisciplines, dating back many decades, including philosophy and history of science; science and technology studies (STS); innovation studies; economics; scientometrics; public policy studies; higher education studies; library, data and information sciences. The timeline below presents a simplified heuristic to illustrate this.[10]

Metascientists do few favours to their credibility if they ignore this heritage, engage in the "Columbusing" of established fields[11], or downplay ongoing interdependencies between metascience and related domains of research, theory and practice.[12]

At the same time, those in more established domains may be unsure whether to relate to metascience with enthusiasm, scepticism, or tactical engagement. As one scholar asked in response to the launch of the UK Metascience Unit: "someone convince me that 'metascience' is anything other than STS [science and technology studies] stripped of any kind of structural or critical analysis."[13] Those who dismiss metascience as little more than opportunistic rebranding should be mindful of Robert Merton's fallacy of adumbrationism—negating novel and genuine advances by reference to an earlier trail of related findings.[14]

10. We focus here less on formal uses of the term 'metascience' – which as Peterson and Panofsky (2023) remind us has its own history, including uses in the mid-1940s by philosopher Charles Morris, in the late-1950s by Mario Bunge, and in the book reviews journal *Metascience* – and more on the spirit of metascientific inquiry, for which we suggest J.D. Bernal as a better modern starting point. Peterson, D, and Panofsky, A. (2023). Metascience as a Scientific Social Movement. Minerva (2023) 61:147–174 https://doi.org/10.1007/s11024-023-09490-3
11. https://www.npr.org/sections/codeswitch/2014/07/06/328466757/columbusing-the-art-of-discovering-something-that-is-not-new
12. In a closing keynote at the 2019 Society for the Social Studies of Science (4S) conference (which coincided by chance with the Metascience 2019 conference), Ruha Benjamin, a leading STS scholar of race and technology, criticised what she saw as the 'Columbusing' of STS by discourses emerging from the technology sector in Silicon Valley, including metascience. https://x.com/MannyMoss/status/1170486064739475457
13. Des Fitzgerald on X: https://x.com/Des_Fitzgerald/status/1727342968971960514?s=20
14. Merton, R. K. (1949). Social Theory and Social Structure: Towards the Codification of Theory and Research. New York, Free Press.

Figure 1: A timeline of metascientific advances over the past century, as reflected in the emergence of new journals or influential books (source: Sarah de Rijcke/RoRI).

The quote from Derek de Solla Price which opens this paper, highlights one strand of the UK's role in this story – drawn as it is from de Solla Price's contribution to *The Science of Science*, a 1964 volume marking the 25th anniversary of J. D. Bernal's *The Social Function of Science*.[15]

Bernal, an eminent physicist whose initial groundbreaking contributions were in x-ray crystallography, became an influential voice in UK debates from the 1930s to 1970s on the history and social responsibilities of science. In *The Social Function* he analyses British science as if viewing it through his microscope, with chapters ranging across its organisation and funding, science education, science communication, science in war, and science in industry. At each turn, his analysis was as quantitative and data-informed as possible.

As the introduction to the 1964 anniversary volume observes, this was "*Bernal's great work… the significance of [which] was recognised immediately*." Moreover, it "*laid the foundations of the subject we now call the Science of Science, that is, the examination of science with the methods of science itself.*"[16]

Published a few months after PM Harold Wilson made his famous pledge to reforge the British economy in the "white heat" of the scientific and technological revolution,[17] the authors of the 1964 collection (who included several FRS pillars of the scientific establishment), positioned themselves at the vanguard of an evidence-driven movement to reform science. Their book was accompanied by the launch of a Science of Science Foundation with a mission "*to promote the application of scientific methods to the understanding of science itself, especially in its relations with society*." This later morphed into the Science Policy Foundation, and survived through into the early 2000s.[18]

The intellectual impetus behind the 1964 volume soon found other outlets too. In 1966, the economist of innovation Chris Freeman, another disciple of Bernal, was invited to join the newly-opened Sussex University as founding Director of its Science Policy Research Unit (SPRU) – the UK's first dedicated centre in this field[19]. The birth of SPRU, by one account, "*represented a "transformative change" in the research on science policy and the understanding of the nature and origin of technological change and innovation studies. It influenced policymakers across the world…[and] made the topic of science, technology and innovation (STI) familiar to business studies scholars.*"[20]

The same year, 1966, the University of Edinburgh founded its Science Studies Unit, which through the work of David Edge, Barry Barnes and David Bloor, and later historian Steven Shapin, became hugely influential for its foundational work on the 'strong programme' within the sociology of scientific knowledge[21]. In 1977, a third UK centre – PREST (Policy Research in Engineering, Science & Technology) – opened at the University of Manchester.[22]

15. Bernal, J. D. (1939). The Social Function of Science. London: Routledge.
16. Goldsmith, M. & Mackay, A. (1964). The Science of Science: Society in the Technological Age. London: Souvenir Press. P.10
17. Edgerton, D. (1996). The 'White Heat' Revisited: The British Government and Technology in the 1960s. *Twentieth Century British History*. 7(1). https://doi.org/10.1093/tcbh/7.1.53
18. The foundation in turn set up the journal *Science and Public Policy*, which (now published by OUP) remains an important venue for metascientific research https://academic.oup.com/spp. For more on the history of the foundation, see Freedman, R. (1984). The Science Policy Foundation (1964–1984) *Science and Public Policy*, Volume 11, Issue 3, June 1984, pp. 161–172, https://doi.org/10.1093/spp/11.3.161 Published: 01 June 1984. The foundation formally closed in 2003. https://register-of-charities.charitycommission.gov.uk/en/charity-search/-/charity-details/313721/governance
19. https://www.sussex.ac.uk/business-school/people-and-departments/spru/about/history
20. Soete, L. (2019). Science, technology and innovation studies at a crossroad: SPRU as case study. *Research Policy*. Volume 48, Issue 4, May 2019, Pages 849-857. https://doi.org/10.1016/j.respol.2018.10.029
21. Williams, R. (2016). Still growing strong 50 years of Science, Technology and Innovation Studies at the University of Edinburgh. EASST Review: Volume 35(3) September 2016
22. Hills, P. (1995). Prest's experience of evaluation. Scientometrics 34, 401–414. https://doi.org/10.1007/BF02018008; see also https://en.wikipedia.org/wiki/Manchester_Institute_of_Innovation_Research#cite_note-10

Other UK universities soon developed their own capacity in STS and innovation studies, or in more established fields of philosophy and history of science. But well into the 2000s, Sussex's SPRU, Edinburgh's SSU (which in 2000 morphed into the Institute for the Study of Science, Technology and Innovation - ISSTI)) and Manchester's PREST (which later became Manchester Institute of Innovation Research – MIOIR) constituted their own 'golden triangle' of UK expertise in the analysis of STI systems and institutions. All three centres were pioneers in the development of theories and methods that remain central to metascience today. And their influence persists today – with Edinburgh's Department of Science, Technology and Innovation Studies surviving largely intact, while SPRU and MIOIR have in different ways been absorbed (and perhaps diluted as a result) within larger schools of business and management.

Through this period, the UK was of course not alone in creating new research centres. Parallel moves were underway in the US, Germany, Netherlands, Japan, South Korea and other advanced or emerging R&D systems, and a patchwork of centres for STI studies and scientometric analysis emerged worldwide.

To mention a handful of examples: in 1969, Norway founded the precursor to what is now NIFU: Nordic Institute for Studies in Innovation, Research and Education; in 1972, Germany established its Fraunhofer Institute for Systems and Innovation Research (ISI).[23] In 1980, the Shanghai Institute for the Science of Science (SISS) opened its doors; as did the Centre for Science and Technology Studies (CWTS) at Leiden University, with its focus on the analysis of new scientometric indicators.

In 1987, South Korea launched its Science and Technology Policy Institute (STEPI), followed the next year by Japan's National Institute of Science and Technology Policy (NISTEP). In 1995, the Centre for Research on Evaluation, Science and Technology (CREST) was established at Stellenbosch University in South Africa – and remains the largest such centre in sub-Saharan Africa. Also in 1995, the University of Campinas in Brazil launched its Laboratory of Studies on Research Organization and Innovation (Lab-GEOPI).[24]

Even with this expansion of global capacity, the UK's influence on metascientific capacity worldwide remained significant, not least through the diverse diaspora of scholars and civil servants who trained at SPRU, SSU or PREST, then returned to apply the insights to their own national STI systems. As one example, the emergence of "the science of science" in China can be traced in a direct line from Bernal, through SPRU, to an influential cadre of Chinese S&T policy researchers who initiated the reform and modernisation of its STI system from the late 1980s and, even more intensively, after 1997.[25]

The growing importance of the European Union in STI policy and investment from the 1980s onwards, and the emergence of the EU Framework Programmes (now in their 9th cycle as Horizon Europe) also saw the UK shaping debates at a European level, at least until the 2016 Brexit referendum, and all that followed.[26] EU funding in turn unlocked new sources of investment for pan-EU collaborative networks of metascientific research.[27]

23. https://www.isi.fraunhofer.de/en/50-jahre-isi.html
24. This is not an exhaustive list but major centres include: NIFU: Nordic Institute for Studies in Innovation, Research and Education https://www.nifu.no/en/nifus-historie/; SISS https://www.siss.sh.cn/eng/ ; CWTS https://www.universiteitleiden.nl/en/social-behavioural-sciences/cwts; STEPI: https://www.stepi.re.kr/site/stepien/main.do; CREST, Stellenbosch: https://www.sun.ac.za/english/Lists/news/DispForm.aspx?ID=11231; Lab-GEOPI https://www.ige.unicamp.br/geopi/en/
25. Zhao,Y., Du, J. and Wu, Y. (2020) The impact of J. D. Bernal's thoughts in the science of science upon China: Implications for today's quantitative studies of science. *Quantitative Science Studies*. 1 (3): 959–968. https://doi.org/10.1162/qss_a_00064
26. Costigan, G. and Wilsdon, J. (2021) UK science, technology and innovation policy after Brexit: priorities, ambitions and uncertainties. London: The Foundation for Science and Technology. April 2021. https://doi.org/10.15131/shef.data.14143877
27. Kuhlmann, S. (2001). Future governance of innovation policy in Europe — three scenarios, Research Policy. Volume 30, Issue 6 pp. 953-976. https://doi.org/10.1016/S0048-7333(00)00167-0. And see e.g. EU-SPRI as one such pan-EU network: https://euspri-forum.eu/about/

5. 21st century metascience: a bit on the side?

In the mid-1990s, there was a shift in the focus of much STI policy analysis away from the inner workings of science systems, and towards the design, cohesion and effectiveness of national innovation systems (within which, basic research is of course only one input). This can be seen in the rise of OECD discourse around "knowledge economies"[28], and in UK policy, was internalised by the flagship STI policy statement of the Blair-Brown governments: the 2004 10-year 'Science & innovation investment framework'.[29]

Few of the dilemmas that exercised Bernal, or remain central to metascience today, are foregrounded in the 2004 10-year framework – with the exception of a heightened concern about fractures in the 'social contract' between science and society, in the wake of public controversies over bovine spongiform encephalopathy (BSE) and the safety of genetically-modified crops. This is reflected in UK metaresearch priorities from that period, with the social/ethical aspects of genomics and innovation studies the two main winners of additional investment from the Economic and Social Research Council (ESRC) and other funders such as Wellcome and Nesta.[30]

From around 2005 onwards, the landscape again began to change. That year saw two interventions – both from the United States – which rippled across the international science community and have, in different ways, shaped metascience as we know it today.

5.1 John Marburger and SciSIP

The first was a brief yet remarkably candid speech made in April 2005 by John Marburger, then science adviser to President George W. Bush and Director of the White House Office of Science and Technology Policy. Citing the work of critical policy scholars such as Dan Sarewitz, Marburger ripped away the veil that the scientific community (on both sides of the Atlantic) tends to draw over evidentiary gaps in arguments for increased investment.

Reminding his audience at the AAAS (American Association for the Advancement of Science) "*how primitive the framework is that we use to evaluate policies and assess strength in science and technology*", Marburger argued "*that the nascent field of the social science of science policy needs to grow up, and quickly, to provide a basis for understanding the enormously complex dynamic of today's global, technology-based society.*" And he closed by calling for "*a new interdisciplinary field of quantitative science policy studies.*"[31]

In the polite circles of American science policy, this speech was dynamite. And Marburger followed through – establishing shortly afterwards a "Science of Science and Innovation Policy (SciSIP)" programme at the National Science Foundation[32], later rebranded as "Science of Science".[33] This and related investments by Alfred P. Sloan Foundation and other philanthropic funders, has supported a vibrant network of economists and data scientists in the US, focused on STI networks and systems.

28. Mahon R, McBride S. Standardizing and disseminating knowledge: the role of the OECD in global governance. European Political Science Review. 2009;1(1):83-101. https://doi.org/10.1017/S1755773909000058
29. HM Treasury/DTI (2004). Science & innovation investment framework 2004 - 2014. See also: http://news.bbc.co.uk/1/hi/sci/tech/6475801.stm
30. See e.g. Diamond, I. and Woodgate, D. (2005) Genomics research in the UK—the social science agenda, *New Genetics and Society*, 24:2, 239-252, https://doi.org/10.1080/14636770500184842; https://ircaucus.ac.uk/
31. Marburger, J. (2005). AAAS S&T Policy Forum Keynote Address Washington, D.C. April 21, 2005 https://scisip.weebly.com/uploads/1/6/8/5/1685925/marburger_2005_aaas_keynote.pdf. The speech was later published in a compressed form in Science (Marburger, J. H. (2005). Wanted: Better Benchmarks. Science. Vol 308: 108, 20 May 2005. https://doi.org/10.1126/science.1114801
32. https://www.nsf.gov/funding/opportunities/scisip-science-science-innovation-policy/501084/pd09-7626
33. https://www.nsf.gov/funding/opportunities/sosdci-science-science-discovery-communication-impact; https://www.nsf.gov/funding/opportunities/sosdci-science-science-discovery-communication-impact. It is unclear what the future will be for this program, given envisaged cuts to the NSF's budget for the next four years.

In 2011, shortly before his death, Marburger co-edited The Science of Science Policy Handbook, with contributions from others involved in the NSF programme. From a metascience perspective, Irwin Feller's chapter on "the emerging community of practice"[34] stands out as particularly aligned to current debates, with its discussion of "data-based science policy" and "science as experimentation" (though the terminology of metascience or metaresearch is not yet in widespread use and doesn't feature).

Marburger's intervention also influenced discussions in the UK, EU and Japan – with, for example, the Royal Society calling for a UK "science of science" programme in its 2010 study *The Scientific Century*.[35] But another decade would pass before an equivalent senior figure in UK research policy – Sir John Kingman, inaugural Chair of UKRI – was to acknowledge in similarly frank terms to Marburger persistent and serious weaknesses in the evidence base for STI policy and funding– and then, only in a valedictory speech as he stepped down from the role.[36]

5.2 Movements for science reform

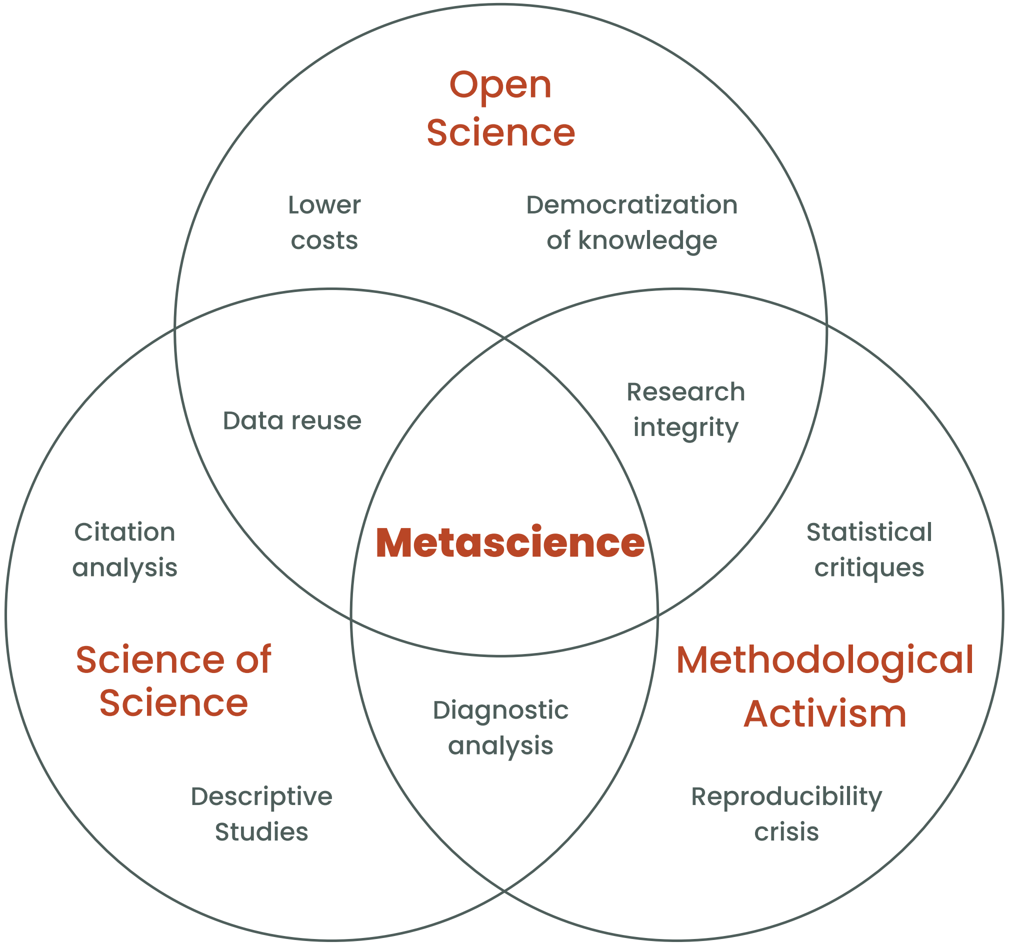
In August 2005, four months after Marburger's speech electrified the AAAS, Stanford's John Ioannidis published in PLOS Medicine 'Why Most Published Research Findings Are False'[37], an analysis which was even more incendiary, and is still being debated twenty years on – but which crystallized for many scientists and policymakers a heightened concern about research transparency, integrity and reproducibility. Ioannidis went on, in 2014, to establish the Meta-Research Innovation Center at Stanford (METRICS), focused on transforming research practices to improve the quality of evidence in biomedicine and other fields.[38] METRICS was one of the first in a new wave of metascience or metaresearch centres to emerge after 2010; centres which differ in their framing and orientation from the SPRU-led wave of the mid-1960s to late-1980s.[39]

Another factor at play from 2000 onwards was an explosion of engagement with open access and open science. From 2002 to 2003, three landmark statements emerged in quick succession – the Budapest Open Access Initiative; Bethesda Statement on Open Access Publishing; and Berlin Declaration on Open Access to Knowledge – and accelerated international support for more open infrastructures of publication, communication and data sharing.

As the open science movement matured, a sub-community within it focused on the interfaces with metascience. The US-based Center for Open Science (COS), co-founded in 2013 by Brian Nosek and Jeff Spies, has been central to this, and in 2019 co-organised the first of what is now a biennial series of "Metascience" conferences.[40] The Global Research Initiative on Open Science (GRIOS), initiated by Marin Dacos, France's National Open Science Coordinator, is another prominent, non-US example of activity at these interfaces.

34. Feller, I. (2011). 'Science of Science and Innovation Policy - The Emerging Community of Practice', pp. 131-155 in Husbands Fealing, K., Lane, J. I. Marburger, J. H. and Shipp. S. S. (eds., 2011). *The Science of Science Policy: A Handbook*. Stanford Business Books.
35. The Royal Society. (2010). The Scientific Century: securing our future prosperity. https://royalsociety.org/news-resources/publications/2010/scientific-century/
36. Kingman, J. (2021). Sir John Kingman – Reflections on his time as UKRI Chair. British Academy, 14 July 2021. https://www.thebritishacademy.ac.uk/events/sir-john-kingman-reflections-on-his-time-as-ukri-chair/. His speech concluded with what he called "*a final smaller point. If I look back on many years of involvement in political decision-making and policy-making around science, innovation and R&D, I am struck by how much of it tends to turn on gut feel of the individuals involved, than on hard evidence and analysis. This is of course ironic, since good science is all about testing hypotheses against data, empirical results and facts*."
37. Ioannidis JPA (2005) Why Most Published Research Findings Are False. PLoS Med 2(8): e124. https://doi.org/10.1371/journal.pmed.0020124
38. https://metrics.stanford.edu/ . RoRI itself is another example of a post-2010 centre, set up by the Wellcome Trust with closely-related goals.
39. Others in this post-2010 wave include the Center for the Science of Science and Innovation (CSSI) at Northwestern University (US); the Meta-Research Centre at Tilburg University (Netherlands); QUEST Center for Responsible Research at Berlin Institutes of Health (Germany); and our own Research on Research Institute (RoRI) (UK and Netherlands).
40. Details here of the 2019, 2021, 2023 and 2025 Metascience conferences: https://www.metascience2019.org/; https://metascience2021.org/; https://metascience.info/;

Image: The strands of metascience (from Peterson and Panofsky, 2023)[41]



In their perceptive analysis of metascience as a 'social movement', the sociologists David Peterson and Aaron Panofsky suggest that metascience has become a meeting point for agendas and actors from these three strands: the more instrumental priorities of the science of science; alongside the more normative reform agendas of the open science and reproducibility movements.

These three strands share a diagnosis of worsening crisis in the science system – focused on reproducibility and questionable research practices, but encompassing related concerns over scientific productivity, bureaucracy, openness, transparency and accessibility:

> "Metascience has produced the tools that supposedly uncovered the crisis through statistical critiques, meta-analyses, and mass replications. Together, these provided the evidence that activists have used to demonstrate systemic problems across fields. And, metascientists have positioned themselves as key players in solving the crisis by pushing for interventions in everything from scientific training to reporting."[42]

41. Peterson, D, and Panofsky, A. (2023). Metascience as a Scientific Social Movement. Minerva (2023) 61:147–174, p.159 https://doi.org/10.1007/s11024-023-09490-3
42. Peterson, D, and Panofsky, A. (2023). Metascience as a Scientific Social Movement. Minerva (2023) 61:147–174, p.152 https://doi.org/10.1007/s11024-023-09490-3

This is a helpful way of making sense of much of the metascience landscape as we find it today. But for its many strengths, Peterson and Panosky's framework still doesn't capture the full diversity of what we now see bubbling up as metascience in the US, UK, EU, Japan, China and elsewhere.

6. Metascience today: five vectors of change

We have focused so far on the connections and continuities between metascience and earlier strands of research, policy and practice. Yet this is only part of the story: we can also see new, different and surprising developments reshaping the landscape of metascience.

What is changing, and why is metascience more visible as a result? We want to explain this through five vectors of change:

6.1 From specialisation to distributed engagement

The line from Bernal to the early 2000s is, in many ways, a familiar trajectory of disciplinary stabilisation, albeit with relatively weak levels of formal institutionalisation in stand-alone university departments, and a strong emphasis on multi and interdisciplinary interactions. But the typical features of disciplinary or subdisciplinary communities have gradually emerged: dedicated journals (such as Research Policy; Research Evaluation; and Scientometrics); specialist research centres (examples listed above) with Masters and PhD programmes; learned societies (such as AsSIST-UK[43]).

By 2012, veterans of these debates, such as Ben Martin at SPRU, feel able to offer a fifty-year retrospective on the field of 'science policy and innovation studies' (SPIS) – and, within this, to delineate what he sees as distinct boundaries between SPIS, science and technology studies (STS), and scientometrics. He concludes that: "*although it is still some way from developing a formal paradigm, SPIS has apparently begun to acquire at least some of the characteristics of a 'discipline'*."[44]

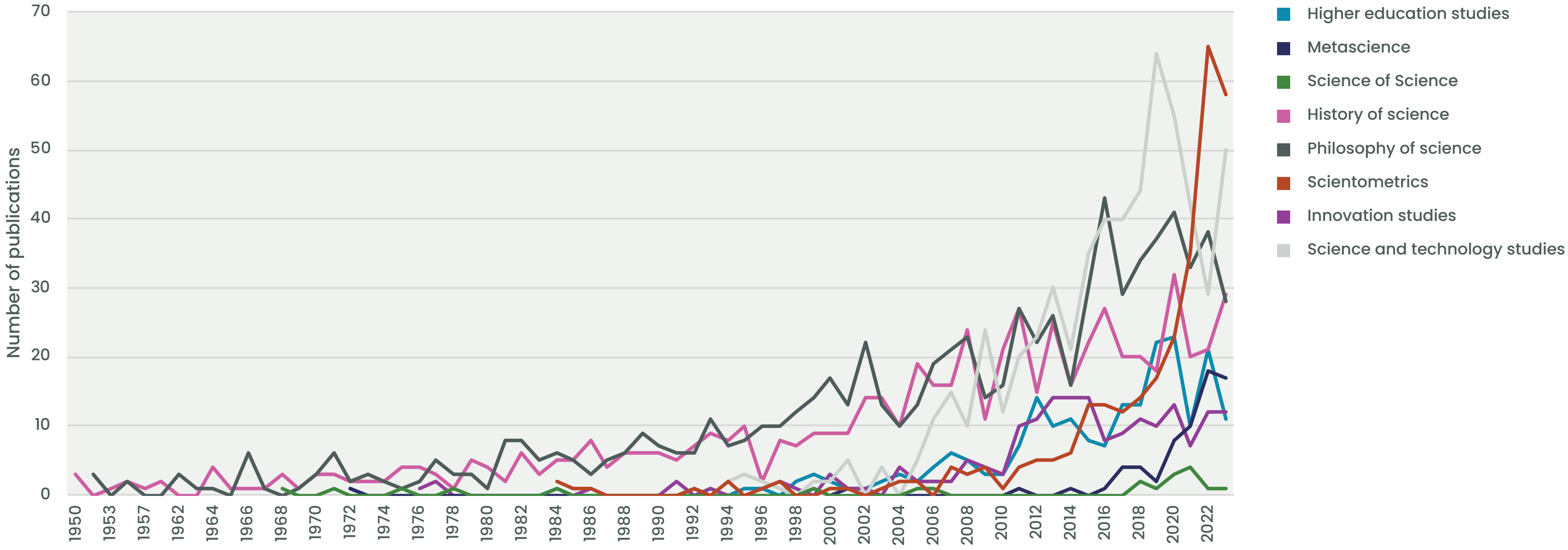
One can tell a similar story for STS[45] and other more-established branches of what we also want to position within the bigger, baggier, undisciplined landscape of metascience. Right at the same point in time where Martin's 2012 analysis of SPIS concludes, in the bibliometric data, we see 'metascience' and 'metaresearch' start to take off (spurred by the developments noted earlier in agendas around open science and reproducibility).

And while SPRU, ISSTI and MIOIR – as noted earlier, the most influential UK centres for 40-50 years – remain important, it is striking that none is central to the recent explosion of metascience in the UK. Indeed, at least for now, metascience and its related terms are conspicuously absent from the web homepages and self-descriptions of all three centres. This isn't hugely surprising – having fought to establish the credibility and disciplinary status of fields like STS and innovation studies, there will be an understandable reluctance amongst incumbents to surrender hard-won ground to alternative framings.

In our analysis, to illustrate the emergence and expansion of metascience over time, and the layering effects of different-yet-related fields, we charted the annual number of publications per field and topic selected for this study. A total of 41,704 publications were selected from the Dimensions database in our global perspective search. Within this 41,704, Figure 2 presents the time trend of fields for the 2716 publications from authors affiliated with UK organisations.

43. https://assistuk.org/
44. Martin, B. (2012). The evolution of science policy and innovation studies. Research Policy 41 (2012) 1219-1239. https://doi.org/10.1016/j.respol.2012.03.012
45. Martin, B. R., Nightingale, P., Yegros-Yegros, A. (2012). Science and technology studies: Exploring the knowledge base. *Research Policy*. Volume 41, Issue 7: 1182-1204. https://doi.org/10.1016/j.respol.2012.03.010

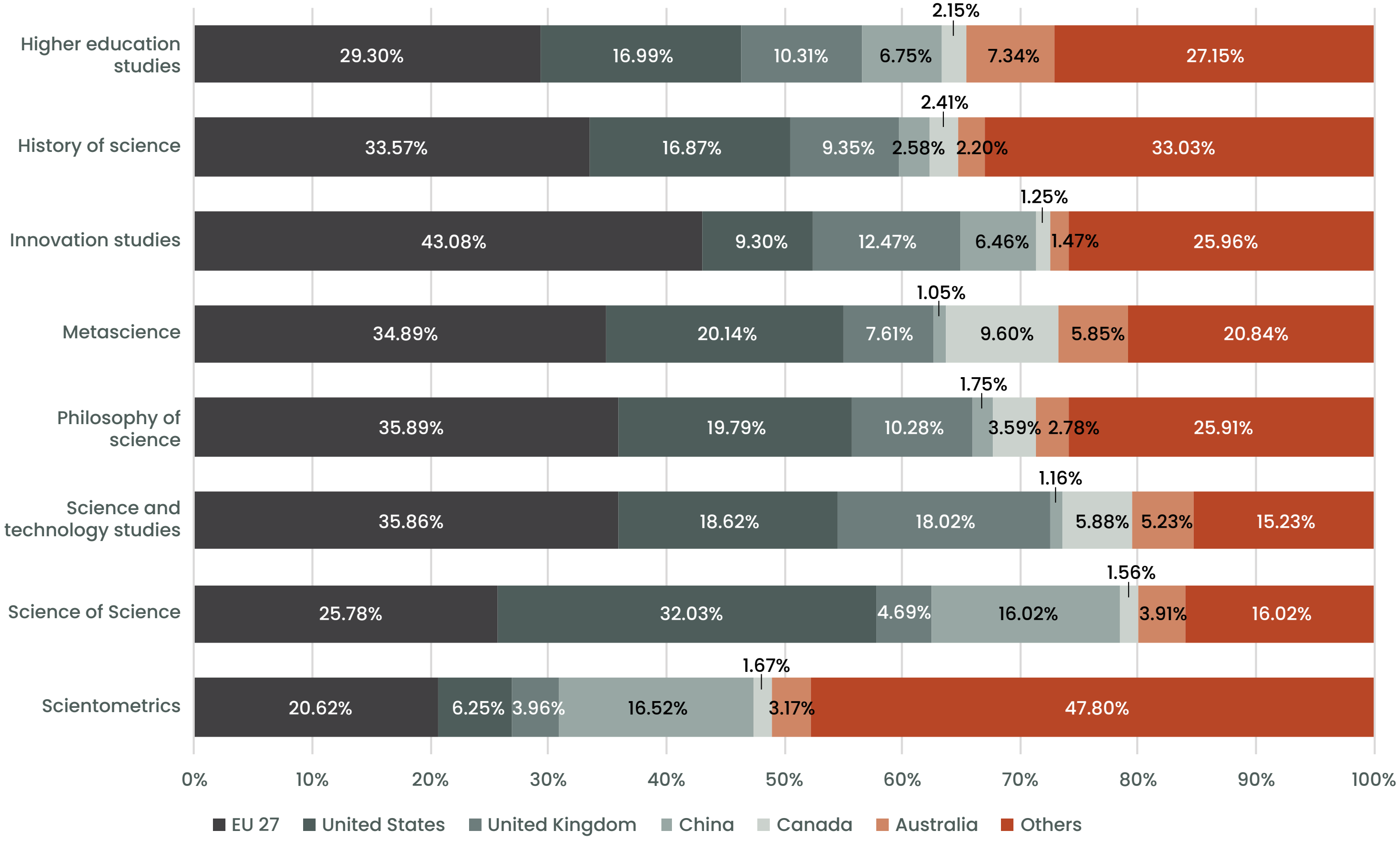
Figure 2: Time trend in the number of publications mentioning various metascience fields in their titles and abstracts, for authors affiliated with UK organisations



The data show, unsurprisingly, that philosophy and history of science have the deepest historical roots. While both continue to grow, their expansion has been overtaken in volume terms by fields such as scientometrics and STS. Other fields, such as innovation studies and higher education studies, have grown in the past two decades. The most dramatic rise in recent years is in scientometrics, which has outstripped nearly every other field.[46]

To then compare the UK's contributions with other countries, we counted affiliations on metascience publications, attributing fractional counts when authors came from different countries (so a paper with two EU27 authors and one US author contributes 2/3 to the EU27 and 1/3 to the US). Figure 3 presents the percentage of publications for selected countries and the fields considered in our study period (2014-2023).

Figure 3: Relative contribution of countries to the publications mapped as metascience fields (2014-2023)



46. Although the term 'bibliometrics' is often used as a synonym of 'scientometrics', we considered only publications that mention 'scientometrics' in their title or abstract. The number of publications in scientometrics would have been substantially larger if we had also considered publications that mention 'bibliometrics' in their title or abstract.

Here, scientometrics as a field has a markedly different profile from the other fields, with large shares for the EU, China and the 'other' group and relatively small shares for the United States and the UK. The UK contributed around 4% of the total number of publications in the field. Innovation studies has an even larger EU share. Higher education studies stands out for its substantial UK and Australian contributions. The largest community in terms of UK contributions is science and technology studies (STS), with 18% of global publications attributed to UK authors, followed by innovation studies at 12%.

Metascience and related terms are the newest additions to the picture in Figures 2 and 3, and have also grown sharply since 2016. But in contrast to dynamics of disciplinary formation and specialisation that characterise growth pathways of more established subfields, engagement in metascience is now coming from all corners of the research system.

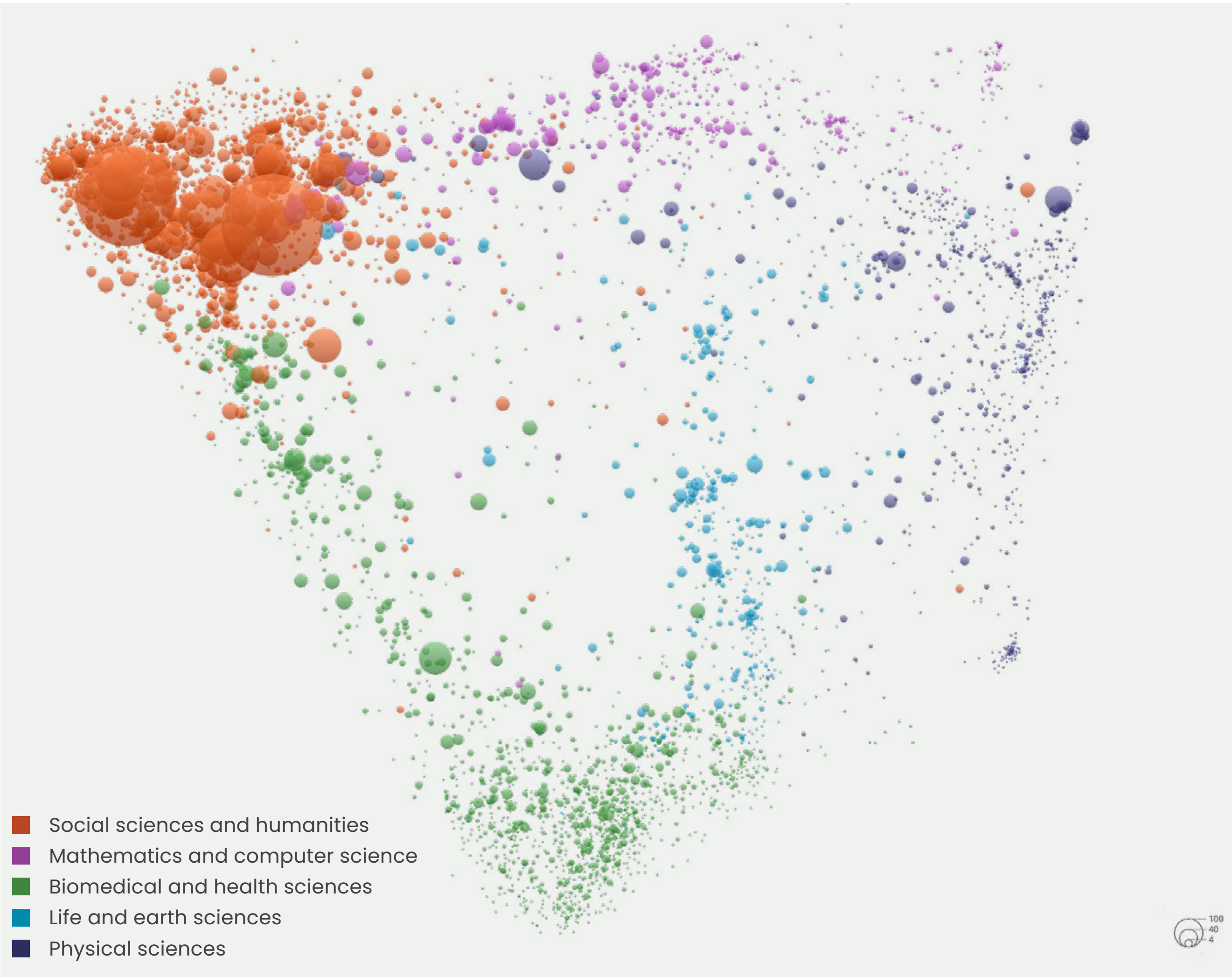
This is why framing metascience as a 'new' or 'emerging' discipline – destined eventually to narrow and domesticate itself onto a conventional disciplinary path – is to miss a crucial part of what makes the present metascience moment so dynamic, diverse and vibrant.

Instead of defaulting to a disciplinary frame, we would argue that metascience is better understood as an orientation or way of engaging with questions that all researchers (and research funders, policymakers, publishers and other actors in research systems) encounter periodically in the networks, disciplines and institutions that they inhabit and work in. These questions may centre on how we govern, deliver, evaluate or communicate research; how to make research funding and investment more agile, efficient and productive; how to reduce the precarity of research careers, and improve the diversity and inclusion of the people and places that contribute to, or benefit from, research; or how to strengthen the integrity, openness, rigour and reproducibility of research findings and underpinning data.

Many researchers and research professionals will choose at certain points in their career to devote time, energy and research capacity to these questions. This does not require a change in their broader research career orientation, nor for them to explicitly identify as 'metascientists'. For many, such activity will remain – properly and positively – a 'side-hustle', pursued part-time on the margins of their primary research system role. The decision to engage in such activity is often born of a frustration with things that aren't working well in one's immediate environment, and a desire first to understand, then to remedy, visible problems, obstacles or failures in that part of the research system.

Figure 4 attempts to reflect this through a visualisation of the panorama of metascience publications in the broader landscape of science. Here we present a map of scientific publications produced by different metascience communities, based on data extracted from Dimensions and visualised using the VOSviewer software. Covering publications from 2014 to 2023, the map shows a landscape of science organised into 4469 thematic clusters of publications, positioning each cluster spatially according to cross-citation links. The size of each cluster indicates the number of metascience publications in the cluster.

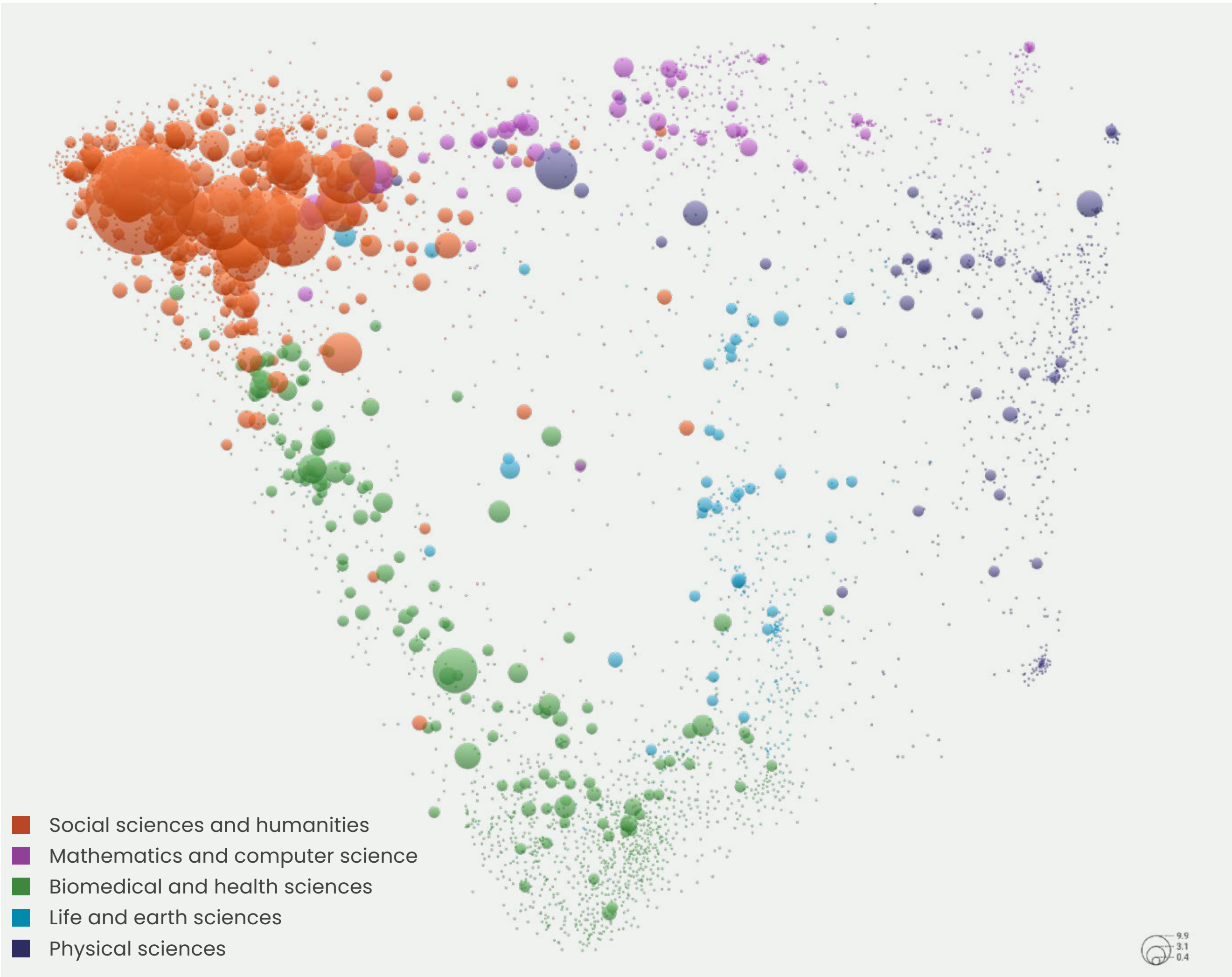
Figure 4: Metascience publications overlaid on the broader research landscape (2014-2023; global results)



This map reveals a strong concentration of metascientific research in the social sciences and humanities, reflecting well-established communities in scientometrics, science and technology studies (STS), science policy and innovation studies (SPIS), higher education studies, and philosophy and history of science. Yet relevant publications are also widely distributed in smaller concentrations across other disciplines, underscoring the extent to which a lot of metascience is now being carried out through highly-dispersed networks of researchers, where this is a secondary focus to their primary areas of research focus.

If the clusters are then resized to represent only those publications co-authored by UK researchers, the resulting map maintains a similar overall distribution, as per Figure 5.

Figure 5: Metascience publications overlaid on the broader research landscape (2014-2023; UK results)



Case study: metascience as a side-hustle

To illustrate our point about the increasingly distributed nature of metascience capability, it may be helpful to put faces on one or two of the smaller dots in Figures 3 and 4.

These would include researchers like Amy Nelson and Parashkev Nachev in UCL's Institute of Neurology, who in light of their own experience of translation research, decided one day to redirect some of the advanced deep learning capabilities that they were developing to analyse the human brain[47] towards a very different problem: how easy would it be to predict real-world translation and impacts from a large corpus of biomedical research papers?

Their model attempted this through complex analysis of full title and abstract content from 43.3 million papers (as distinct from citations and metadata alone, as is the normal approach in scientometrics). And their findings, published in 2022, suggest that "*deep learning models of publication, title, and abstract content can predict inclusion of a scientific paper in a patent, guideline, or policy document. We show that the best of these models, incorporating the richest information, substantially outperforms traditional metrics of paper success—citations per year…*"[48] This work became part of an ongoing programme at the NIHR UCLH Biomedical Research Centre (BRC) to create scalable systems for monitoring and predicting impact with higher fidelity than standard metrics allow.

Another example is Mark Hanson, Pablo Gómez Barreiro, Paolo Crosetto and Dan Brockington, who in 2022, became alarmed by an explosion of 'special issues' and indexed articles in their different fields, being promoted by open access publishers such as Frontiers and MDPI, and potentially resulting in large volumes of lower-quality work entering the literature. Central to their collaboration is its radical interdisciplinarity, spanning biology, botany, economics and anthropology, which allowed them to see patterns across scientific publishing as a whole. Instead of grumbling and doing nothing about it, Hanson and colleagues decided to direct their web-scraping and R-skills at the issue – eventually resulting in an influential paper on 'the strain in scientific publishing', published first as a preprint, then in the scientometric journal Quantitative Science Studies (QSS)[49]

Are Nelson, Nachev, Hanson and colleagues metascientists? Yes, in that they are all involved in cutting-edge metascientific analysis. But it also remains a side-project for them. And while they may well do more such research in future, it is unlikely to displace their primary fields of focus.

47. https://profiles.ucl.ac.uk/1886-parashkev-nachev
48. Nelson, A.P.K. et al (2022). Deep forecasting of translational impact in medical research. *Patterns*. Volume 3, Issue 5, 2022,100483. https://doi.org/10.1016/j.patter.2022.100483.
49. Hanson, M. A., Gómez Barreiro, P., Crosetto, P. and Brockington, D. (2024). The strain on scientific publishing. Quantitative Science Studies 2024; 5 (4): 823–843. https://doi.org/10.1162/qss_a_00327

6.2 Rapid uptake of innovative methods

These are just a few of many hundreds of examples one can find across the UK and global research system – reinforcing the need for flexible approaches to mapping and defining metascience. And it is precisely these kinds of distributed contributions by researchers in all fields, and from others across the wider research system, that are such an important source of the energy, creativity and methodological innovation now propelling metascience forward. They ensure the rapid adoption and adaptation of new methods and tools from across the research system into a metascientific context.

The menu of methods and tools available for metascientific analysis is expanding fast, through a combination of new techniques for network analysis; advances with LLMs and other AI models; and novel scientometric indicators. Moves to build and sustain better infrastructures for open research information and meta-data – such as the OpenAlex database[50] – are building momentum through initiatives such as the Barcelona Declaration on Open Research Information.[51]

As in many other walks of life, advances in AI are currently a great focus of attention and expectation in metascience. A recent paper by Google DeepMind highlights "foundational policy questions" for metascience that AI models could help to answer, including:

"where is the most impactful AI for Science research occurring and what types of organisations, talent, datasets, and evaluations are enabling it? To what extent are scientists using and fine-tuning LLMs vs more specialised AI models, and how are they accessing these models? To what extent is AI actually benefiting or harming scientific creativity, reliability, the environment, or other domains? How is AI affecting a scientist's perception of their job and what skills, knowledge gaps, or other barriers are preventing their broader use of AI?"[52]

6.3 Targeted policies and investment

Within central governments, the UK Metascience Unit is one of the more prominent initiatives in this area[53], and is generating interest as a model among policymakers elsewhere. But the UK is far from alone in elevating metascience as a priority for policy or funding. Elsewhere, we see new policies, investments and alliances being forged, including:

- in the European Union, where the recent Heitor Report on design options for the next Framework Programme (FP10) called for a new unit to drive ongoing experimentation with funding modes and instruments;[54]
- in Canada, where three public funding agencies (all partners of RoRI) have joined forces to initiate a co-funding call for meta-research;[55]
- in Germany, where the Volkswagen Foundation has a funding programme on "Researching Research" and continues to experiment with its own processes;[56]

50. https://openalex.org/
51. https://barcelona-declaration.org/
52. Griffin, C. Wallace, D., Mateos-Garcia, J., Schieve, H. and Kohli, K. (2024). A new golden age of discovery. Seizing the AI for science opportunity. Google DeepMind, November 2024.
53. Chawla, D. S. (2024). The UK launched a metascience unit. Will other countries follow suit? Nature Index, 7 August 2024. https://doi.org/10.1038/d41586-024-02469-4
54. https://op.europa.eu/s/z5LS;https://sciencebusiness.net/news/fp10/news-analysis-eu-needs-experiment-new-ri-funding-mechanisms-heitor-report-says
55. https://www.sshrc-crsh.gc.ca/funding-financement/programs-programmes/research_on_research_joint_initiative-initiative_conjointe_de_recherche_sur_la_recherche-eng.aspx
56. https://www.volkswagenstiftung.de/en/funding/funding-offer/researching-research-collaborative-research-projects; and https://researchonresearch.org/dpr-volkswagen-foundation-first-results/

- in France, where Marin Dacos, National Open Science Coordinator, has catalysed investments in the 'science of open science' by the French system, and internationally through the Global Research Initiative on Open Science (GRIOS);[57]
- in China, where a 2024 Shanghai Declaration for the Science of Science called for more coordinated investment in these fields,[58] and where the National Natural Science Foundation of China (NSFC) is experimenting with novel approaches to review and grant selection on a more ambitious and systematic scale;
- in Switzerland, where the Swiss National Science Foundation (SNSF) now has a well-embedded institutional commitment to "evidence-informed development of its funding and evaluation processes."[59]
- in the Netherlands, which now has a dedicated funding program for 'research on open science'.[60]
- in Japan, where enhancing "strategic intelligence" and metascience-related capabilities are firmly on the agenda for the forthcoming 7th Basic Plan for STI, enabled in part by a new cross-government evidence data platform ("e-CSTI");
- in Ireland, where the recent launch of Research Ireland as a combined research funding agency, has prompted fresh efforts to embed metascience in its structures and priorities;
- the OECD, which in its latest annual STI Outlook stresses the critical importance of investing in the evidence base for STI decision-making, and (while not yet adopting the language of metascience) calls on governments to invest more in *"strategic intelligence" capabilities "to formulate, design and implement effective STI policy agendas and measures."*[61]

6.4 Expanding and overlapping coalitions

As noted above, one way of making sense of metascience is as a meeting point for coalitions that have formed across the global research system over the past 20 years in response to agendas of open science, reproducibility, efficiency, diversity and inclusion. The perceived crisis in research integrity and reproducibility has been a particular spur to the emergence of grassroots movements within science, which have grown rapidly in several countries. The UK Reproducibility Network (UKRN) is one example, which now foregrounds connections between reproducibility and metascience in its work.[62] Similar dynamics can be observed in the formation and growth of social and professional movements for reform of research assessment, including DORA (San Francisco Declaration on Research Assessment) and C0ARA (Coalition for Advancing Research Assessment).[63]

57. https://www.ouvrirlascience.fr/building-a-global-research-initiative-on-open-science-2/
58. https://www.siss.sh.cn/eng/c/2024-06-12/648263.shtml
59. https://www.snf.ch/en/QJEZQ8EPC4CnN4Vm/news/two-days-of-research-on-research
60. https://www.openscience.nl/en/news/research-on-open-science-help-build-a-solid-evidence-base
61. OECD (2023). OECD Science, Technology and Innovation Outlook 2023. Enabling Transitions in Times of Disruption. Paris: OECD, p.88 https://www.oecd.org/en/publications/oecd-science-technology-and-innovation-outlook-2023_0b55736e-en.html
62. See e.g. UKRN's Meteor project: https://www.ukrn.org/activities/enhancing-research-culture/
63. Rushforth, A. and Hammarfelt, B (2023); The rise of responsible metrics as a professional reform movement: A collective action frames account. *Quantitative Science Studies* 2023; 4 (4): 879–897. https://doi.org/10.1162/qss_a_00280; Rushforth, A., Sivertsen, G., Wilsdon, J., Bin, A., Firth, C., Fraser, C. et al. (2025). A new typology of national research assessment systems: continuity and change in 13 countries. RoRI Working Paper No.15. Research on Research Institute. https://doi.org/10.6084/m9.figshare.29041787.v4

Pulling back to a more macro perspective, it is important to remember that over roughly the same 20-year period, global levels of public and private R&D investment tripled —to around US $2.5 trillion a year.[64] This investment has brought with it heightened aspirations and accountabilities to government, shareholders and society, including for:

- faster returns and more measurable impacts from R&D investment through alignment to specific priorities, missions and global challenges;
- new modes of inter- and transdisciplinary research that take their impetus from external priorities and economic or social needs;
- reductions in research waste, duplication and inefficiency;
- higher-performing research institutions and cultures, in terms of agility and flexibility, diversity and inclusion, and integrity of research practices.

As a result, on top of the three agendas highlighted by Peterson and Panofsky[65], further priorities and concerns have been layered:

- that rates of scientific progress in general, or novel/breakthrough advances in particular, are slowing down, in part because research systems are becoming bloated by excessive bureaucracy and specialisation;[66]
- that research funding is too slow and conservative in its range of methods and instruments;[67]
- that the peer review system (on which much of the normal functioning of science depends) is under severe strain and in danger of collapse;[68]
- that institutional or national frameworks of research assessment are over-reliant on weak metric proxies, and that these metrics in turn create perverse incentives, heighten career precarity, exacerbate inequalities, and lead to questionable research practices.[69]

To further enrich and complicate the picture, there are distinct (in some cases, substantial) networks and subfields of researchers, policymakers and practitioners active on an array of topics which might be considered part of, or aligned to, a more expansive interpretation of metascience. These include elements within (though not the entirety of) research communities focused on:

- research translation, uses and impacts – sometimes discussed in terms of "research on research use";[70]
- meta-analysis and synthesis of research evidence across a variety of fields (including on the design, operations and cultures of research itself);[71]
- research collaboration and "the science of team science";[72]
- international collaboration and competition in STI, sometimes described in terms of the "science of science diplomacy" or "research on research security";[73]

64. https://www.statista.com/topics/6737/research-and-development-worldwide/
65. Peterson, D, and Panofsky, A. (2023). Metascience as a Scientific Social Movement. Minerva (2023) 61:147–174, p.159 https://doi.org/10.1007/s11024-023-09490-3
66. Matthews, D. (2025) Are groundbreaking science discoveries becoming harder to find? Nature, Vol 641: 836-838, 21 May 2025 https://doi.org/10.1038/d41586-025-01548-4
67. Nielsen, M. and Qiu, K. (2022). The trouble in comparing different approaches to science funding. https://scienceplusplus.org/trouble_with_rcts/
68. Waltman L, Kaltenbrunner W, Pinfield S, Woods HB. How to improve scientific peer review: Four schools of thought. Learn Publ. 2023 Jul;36(3):334-347. https://doi.org/10.1002/leap.1544
69. Rushforth, A., Sivertsen, G., Wilsdon, J. et al. (2025). A new typology of national research assessment systems: continuity and change in 13 countries. RoRI Working Paper No.15. Research on Research Institute. Preprint. https://doi.org/10.6084/m9.figshare.29041787.v4
70. Farley-Ripple, E.N., Oliver, K. & Boaz, A. Mapping the community: use of research evidence in policy and practice. *Humanit Soc Sci Commun* 7, 83 (2020). https://doi.org/10.1057/s41599-020-00571-2
71. Gurevitch, J., Koricheva, J., Nakagawa, S. et al. Meta-analysis and the science of research synthesis. *Nature* 555, 175–182 (2018). https://doi.org/10.1038/nature25753
72. Stokols, D., Hall, K. L.,Taylor, B.K. and Moser, R.P. (2008). The Science of Team Science: Overview of the Field and Introduction to the Supplement. *American Journal of Preventive Medicine*. Vol 35:2, pp. S77-S89. https://doi.org/10.1016/j.amepre.2008.05.002; Bozeman, B and Youtie, J. (2017). *The Strength in Numbers: The New Science of Team Science*. Princeton University Press.
73. https://royalsociety.org/blog/2024/02/science-diplomacy-15-years-on/; https://www.nsf.gov/funding/opportunities/rors-research-research-security-program

- research and development of research software or research data infrastructures;[74] and
- developmental meta-research, which focuses on specific connections and contexts for metascience within international development.[75]

Finally, to cast our metascientific nets even wider, if we look beyond universities and public research organisations, we can see a swelling cadre of analysts, data-crunchers and decision-makers in technology companies (such as Google DeepMind), funding agencies and foundations (including UKRI, Wellcome and the research funders that RoRI works with across 15 countries); government ministries; private labs and think-tanks; scholarly publishers and data providers – who are deploying advanced methods to investigate and improve research systems in various ways.

This diversity is reflected in the almost 800 participants registered to attend Metascience 2025, drawn from 60 countries and all of the sectors and organisation types mentioned here.

More visible engagement by a handful of technology firms and other companies in metascience raises interesting questions about how it relates to research on the sectoral or firm-level dynamics of industrial and business R&D. This is of course a huge field in its own right, often discussed as innovation studies, or seen as a subfield of economics, business and management research. To date, metascience has tended to focus on public research systems, with less to offer to debates over business R&D. This makes sense in terms of the emergent and bottom-up properties of metascience we describe above – if the impetus for doing metascience has largely been the intrinsic motivations of those in different parts of the research landscape seeking to fix problems in their epistemic and institutional backyards. But in terms of substantive research agendas, there is no logical basis for this separation, and engagement with "private sector metascience" or "meta-innovation" seems likely to grow in line with an expanding cast of institutional actors.

What light can our UK data shine on the expanding and overlapping coalitions in metascience? This can be seen partly in our topic modelling analysis. Here our Dimensions search resulted in 423,432 publications, of which researchers with a UK affiliation are authors or co-authors of 29,757. Over the period 2000-2023, the shift in attention and emphasis on specific topics is shown in Figure 6.

74. As reflected in coalitions such as the Research Software Alliance https://www.researchsoft.org/
75. Forscher, P. S. and Schmidt, M. (2024). A Better How: Notes on Developmental Meta-Research. Nairobi: Busara. This edited volume presents developmental meta-research as a subdiscipline which "*turns meta-research's behaviourally-informed critical lens towards topics that have traditionally been the focus of global development practitioners [in order to] mobilize a new community around improving how research is done in development.*"

Since 2000, several topics have gained significant global attention, reflecting shifts in priorities across the research community. As shown in Figure 6, open science has seen remarkable growth in the UK, where over 1000 publications are produced annually on the subject. Other critical themes such as research impact, research funding, and research ethics have experienced notable increases in academic output, reflecting the growing emphasis on assessing the societal contributions of research, ensuring sustainable funding mechanisms, and the importance of ethics, research integrity and transparency in research.

The distribution of contributions to these topics varies by country, as illustrated in Figure 7, which adopts the same analytical approach used in the analysis by field presented in Figure 3.

Figure 6: Growth in the number of publications since 2000 in topics considered relevant to metascience communities, with authors affiliated with UK organisations

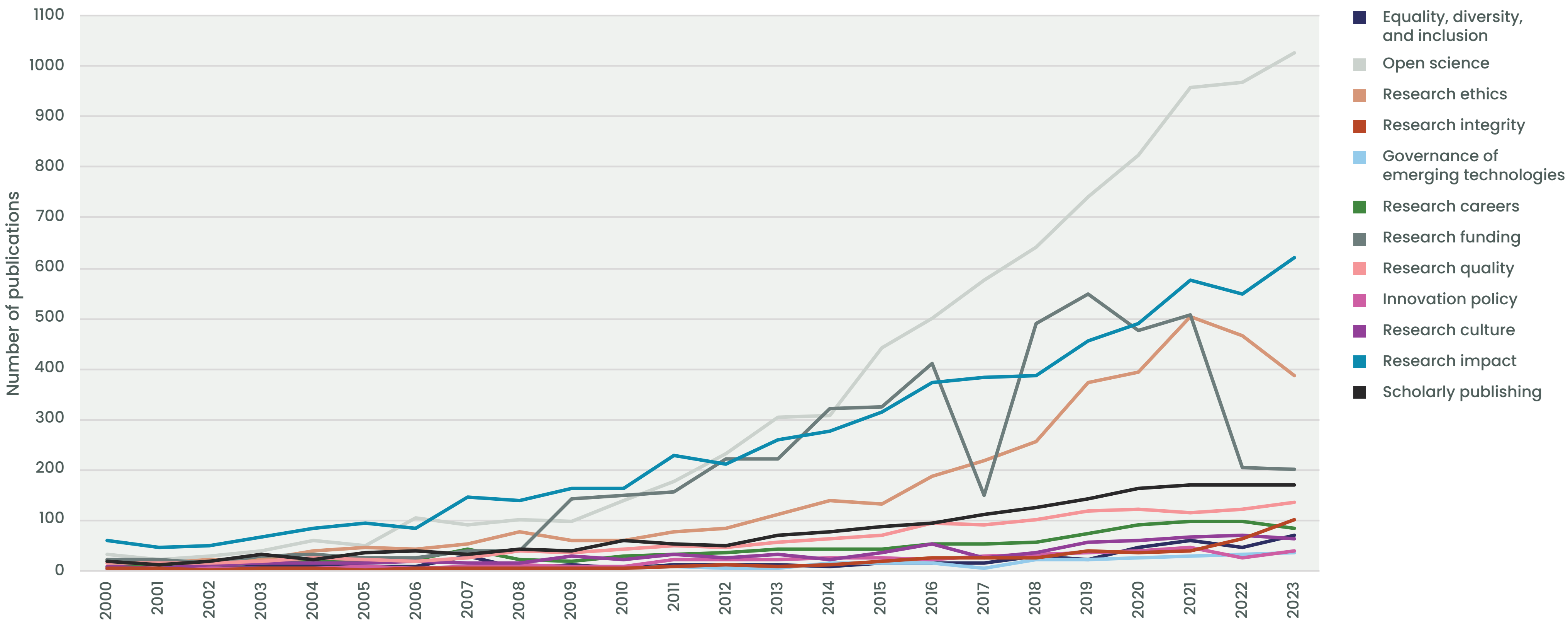
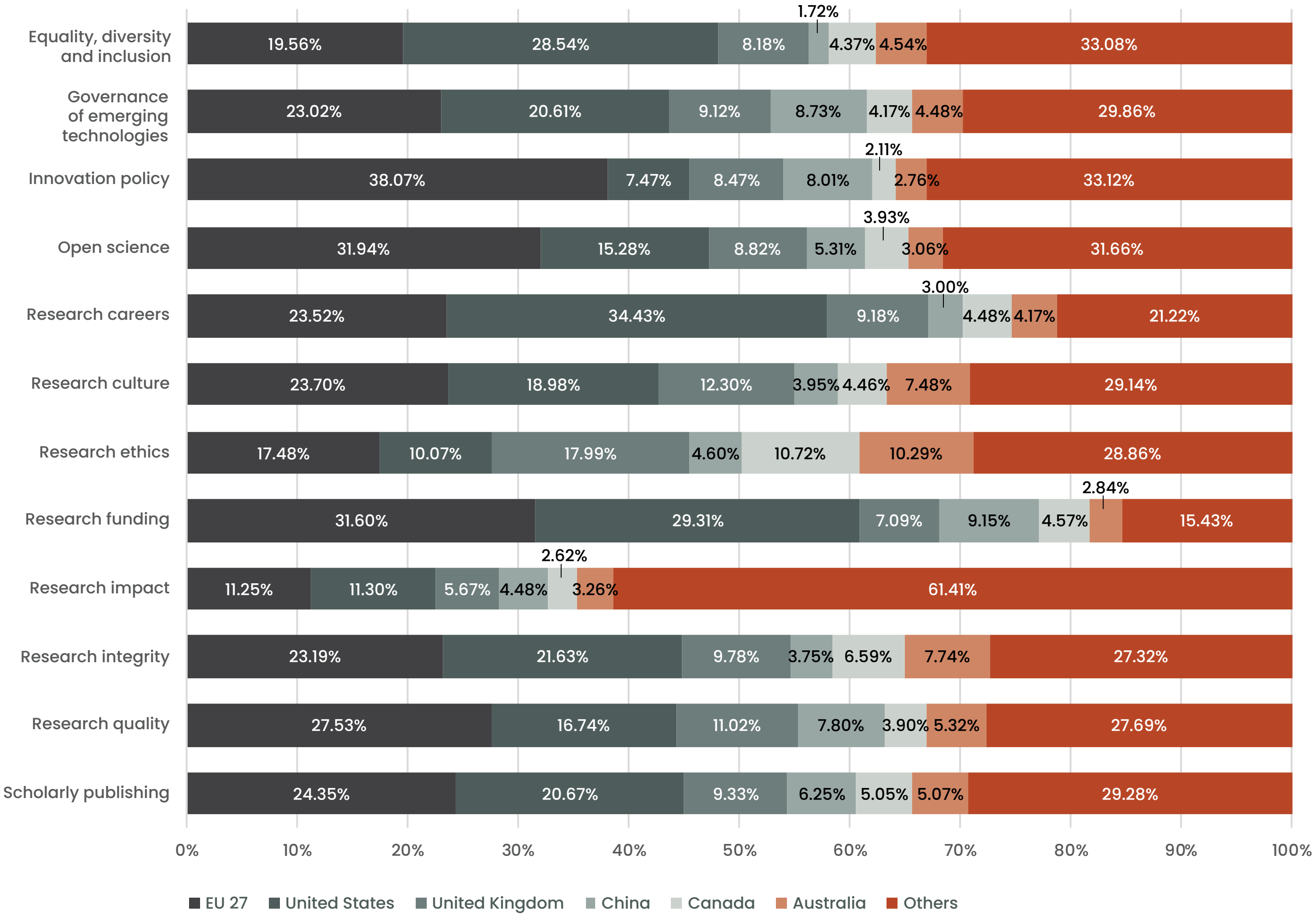


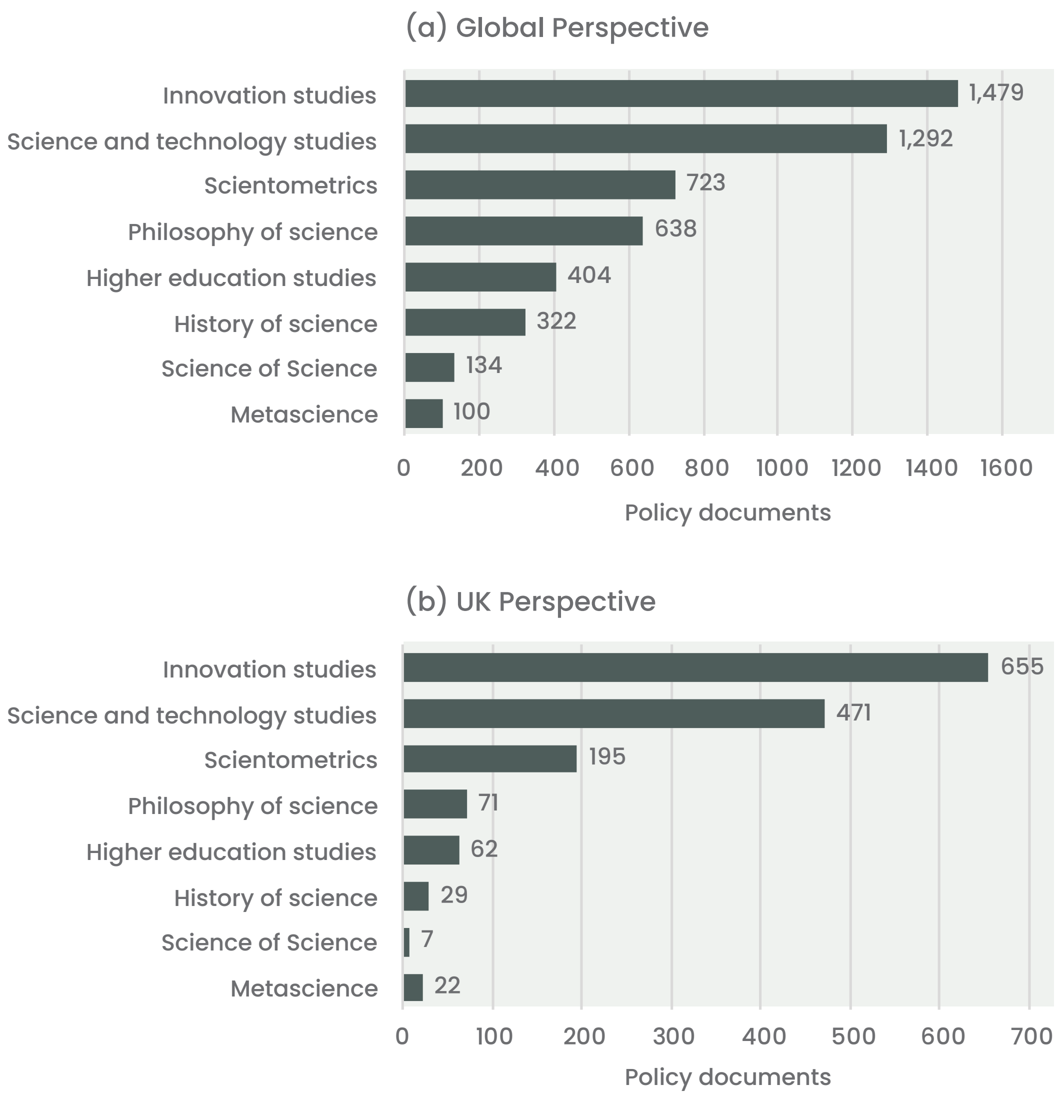
Figure 7: Relative contribution of countries to the publications mapped as topics of relevance for metascience communities (2014-2023)



Some of the growth seen in Figure 6 aligns with global trends; however, Figure 7 shows the UK stands out for its emphasis on research ethics, with an 18% share of global publications on this topic. Such differences highlight specific national priorities and regulatory landscapes, influencing the scope and intensity of research efforts. For instance, while attention to research impact has also grown significantly in the UK over the past decade, attention to this topic is shared by multiple countries, with 61% of publications originating from countries beyond those highlighted in the chart.

Using our refined search strings, we pulled out the papers from the Dimensions database referenced in policy literatures indexed by Overton. Overton harvests documents straight from policy-making bodies, such as government ministries, agencies and similar organisations, as well as from aggregators like the Analysis and Policy Observatory (APO), which curates research articles, books, theses, reports and other grey literature from a wide range of sources. Figure 8 shows the number of policy documents citing global and UK publications in the 2014-2023 period.

Figure 8: Number of policy documents that cite publications within metascience communities from 2014-2023, including (a) global and (b) UK perspectives

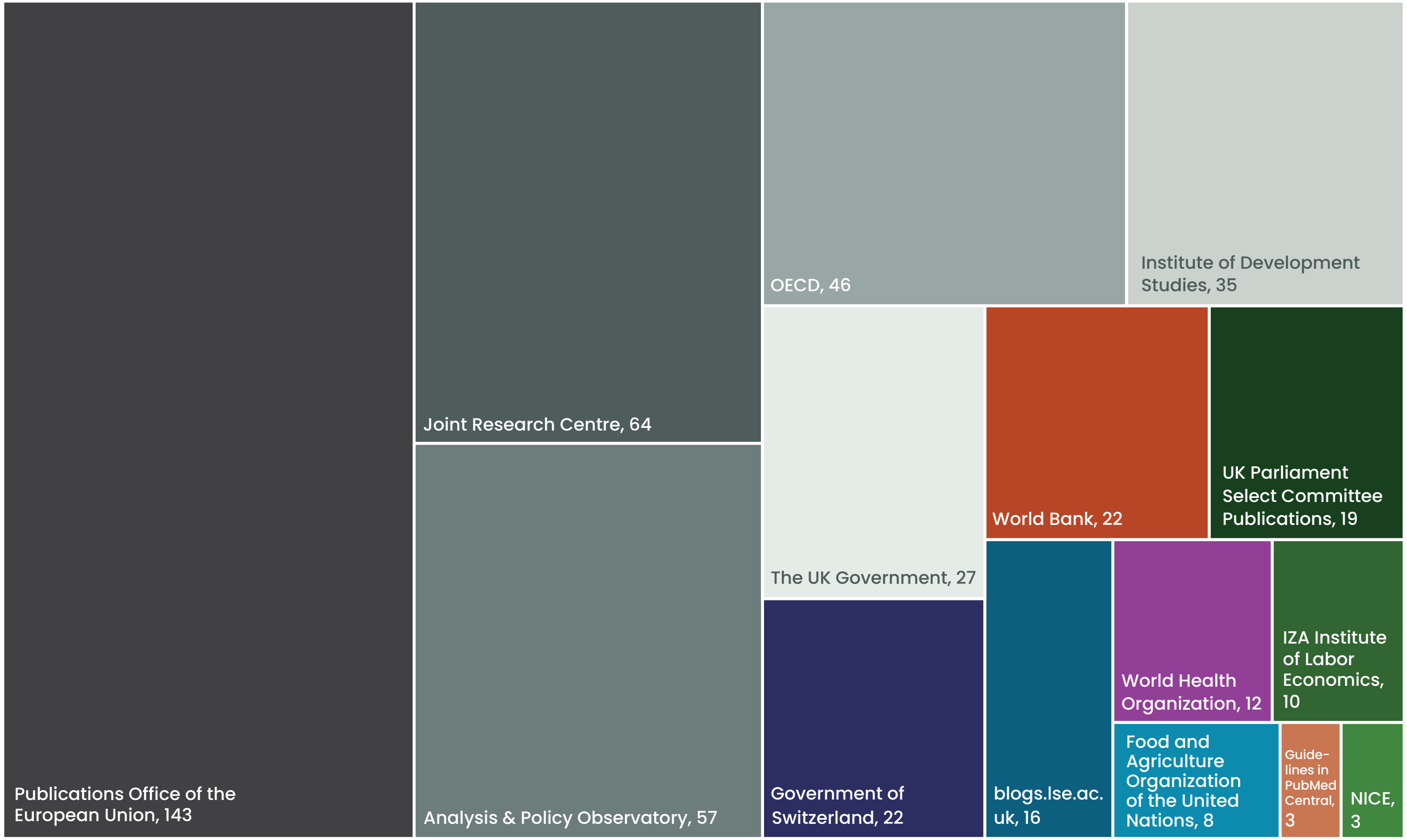


The ranking of policy attention given to metascience 'sub-communities' remains consistent across global and UK perspectives. As illustrated in Figure 8, innovation studies are prominent, followed closely by science and technology studies. This alignment suggests the UK's research priorities are well integrated with global trends in analysing and optimising research systems. However, in the third community of attention – scientometrics – the charts reveal a marked reduction in the proportion of attention given to publications co-authored with UK researchers.

One contributing factor to this observed reduction could be the composition of the top organisations citing metascience publications originating from the UK, as seen in Figure 9.

Notably, many of these citing organisations are international, rather than UK-based, institutions. This distribution suggests that while UK research remains influential, much of its impact is mediated through international networks rather than domestically. Consequently, the visibility of UK-based contributions within global metascience may appear diminished in areas focused more on locally relevant issues, despite substantial international engagement and influence.

Figure 9: Top 15 organisations in terms of the number of policy documents citing metascience publications from the UK (2014-2023)



From a thematic perspective, the analysis of policy documents citing research publications reveals minimal differences between global and UK-specific focuses, as shown in the word clouds below, which reflect the thematic classifications from Overton and highlight the main topics of those policy documents, considering the global and UK perspectives (Figure 10).

Figure 10: Main topics of policy documents citing metascience publications

(a) Global perspective

(b) UK perspective

According to data from the Overton database, the most prominent topics maintain a consistent presence across both scales. This thematic convergence suggests that the UK's contributions to metascience-related policy debates resonate with global priorities, reflecting shared concerns and mutual goals.

Finally it is worth reminding ourselves that all this data reflects a period before the launch of the UK Metascience Unit and the various funding programmes and other activities that it has initiated. Given the scale of activity and investment involved, we can anticipate that the UK Metascience Unit is likely to have a discernible constitutive effect on topic selection, visibility and impacts of UK metascientific research.

6.5 New institutions with metascience at their core

Our final vector of change is still tentative and emergent but potentially the most disruptive. It involves a wave of new institutions less focused on doing metascience – as an object of research or goal of coalition-building and advocacy – and more on being or embodying metascience – in their core design principles, mission and goals.

These include a cluster of new research institutes, mainly in and around Silicon Valley, which operate outside the public research system, yet are distinct from private sector start-ups in terms of their non-profit status; ambitious research goals (often a long way from a 'near-market' focus likely to attract venture capital); and deep-pocketed founders or investors. Prominent examples include:

Arc Institute – founded by Silvana Konermann, Patrick Hsu, and Patrick Collison, and based in Palo Alto, this nonprofit institute has a focus on complex diseases, and is, in its own words, "organized around three key concepts, each consisting of an institutional experiment on how research can be accelerated. We seek to foster an environment built on scientific curiosity, a deep commitment to truth, and interdisciplinary collaboration."[76]

Astera Institute – founded by Jed McCaleb and Seemay Chou, Astera started from a conviction that "the coming years will bring an era of unprecedented scientific and technological advancement...This inflection point provides an unparalleled opportunity, and an urgent mandate, to fundamentally rethink the institutions, systems, and tools that drive scientific progress. We believe an abundant future for all is possible – but not inevitable. To bring it about, we must rebuild the machinery of science to be more efficient, scalable, and open."[77] Through a range of programs, Astera "supports publicly minded innovators whose work isn't a match for other institutions." This has included an influential strand of work on metascience as an "imaginative design practice", led by open science pioneer Michael Nielsen.[78]

Convergent Research – with links to Eric Schmidt, former CEO of Google, Convergent aims to "incubate, find philanthropic donors for, and launch focused research organisations (FROs)". These are "focused" in the sense that "they pursue prespecified, quantifiable technical milestones rather than open-ended, blue-sky research. They must achieve these milestones within a finite time (usually ~5 years) to avoid mission creep and preserve focus...". As its website further explains, "FROs are not intended to be a replacement for any part of the existing scientific ecosystem. And most of the world's scientific endeavors don't need to be done via an FRO. But we have found that a large number of important scientific problems require a structure like an FRO to be tackled. Just as startups make it possible to pursue ambitious business ideas outside of large companies, FROs enable individuals outside existing institutions to pursue ambitious, engineering- and operations-intensive, scientific public goods projects."[79]

Other institutions which merit mentioning in this context include:

- New models of philanthropy – such as those piloted by Open Philanthropy (which, though US-based, co-invested with UKRI in the first UK metascience grants call in 2024), Schmidt Futures, and Chan Zuckerberg Initiative (CZI).
- New public agencies – these are less common, owing to the many constraints around public spending and accountability, but there are now a small yet growing number of innovative public funding models and agencies, of which UK's ARIA (Advanced Research and Invention Agency) is one high profile example.

76. https://arcinstitute.org/model
77. https://astera.org/vision/
78. Nielsen, M. and Qiu, K. (2022). A Vision of Metascience: An Engine of Improvement for the Social Processes of Science https://scienceplusplus.org/metascience/
79. https://www.convergentresearch.org/about-fros

- New infrastructures – which contribute in practical ways to building the systems and architectures needed for open, transparent, interoperable and metascientifically informed research systems. This takes us back to the Barcelona Declaration on Open Research Information[80] and a rich ecosystem of open platforms and tools launched or piloted in recent years. New platforms for peer review and scholarly communication represent another critical infrastructure development. MetaROR (MetaResearch Open Review), which RoRI built and launched in partnership with AIMOS (Association for Interdisciplinary Meta-Research and Open Science), is a recent example.[81]
- New alliances – we have already noted how alliances were instrumental to metascientific analysis and reforms of research assessment (via DORA, CoARA etc). In other areas too, new alliances are one means through which innovations in organisational design, mission and strategy can be experimented with, and scaled if they work. The Metascience 2025 conference in London will include the formal launch of a new Metascience Alliance, which aims to provide a source of light-touch coordination, capacity and community-building for the diverse array of organisations now active in metascience.

7. Conclusion: reframing metascience

Through our own data – presented through ten figures – and our broader analysis of recent developments in policy, funding and institutions, this paper has offered a snapshot of the past and present state of metascience in the UK. It is a busy, fast-moving and chaotic landscape to make sense of and navigate. As we have tried to show, many aspects of what we now call metascience are not new, but there are also a raft of novel, exciting and potentially destabilising things happening too.

We are living through a metascientific moment. Quite where this leads, and whether the transformative potential of metascience is realised in the UK and elsewhere is uncertain. In a tightly-networked global system, positive advances in the UK may yet be eclipsed or derailed by turbulence elsewhere.

Modest advances or experiments with how we manage research funding or assessment may be less important in the long run than the creation of new infrastructures and institutions. Stian Westlake, Executive Chair of the UKRI Economic and Social Research Council, draws an elegant distinction between what he describes as the 'Apollonian' and 'Dionysian' branches of metascience:

> "The Apollonians bring the rigour of careful study from a range of fields, including the social sciences but also history, information studies and computer sciences…The Apollonian vision of metascience is that the tools of research can help us improve research itself…. The Dionysians, on the other hand, embody a visceral feeling that science could be done better. They include a fair share of scientists dissatisfied with existing funding systems or research incentives. It also draws heavily on Silicon Valley and Rationalist ideas, not least the enthusiasm for disruption…"
>
> Stian Westlake, Executive Chair of the UKRI Economic and Social Research Council

80. https://barcelona-declaration.org/
81. https://metaror.org/

As we have also argued, imagining metascience as a discipline-in-the-making is to miss much of what makes it so dynamic, diverse and potentially disruptive. Instead, we propose reframing it in two ways:

First, metascience as a discourse coalition. Originally proposed by Maarten Hajer as a means of examining competing perspectives in environmental politics, the idea of a discourse coalition centres on how problems are constructed through discourses, or "a specific ensemble of ideas, concepts, and categorisations…".[82] And it suggests that language is the main route through which different actors articulate their perceptions of a given problem and position themselves in relation to it, as well as to each other.[83] Given the diverse, historically rich and functionally overlapping terminologies, interests and agendas now visible and active in UK and global metascience, this approach allows us to sidestep potentially unproductive skirmishes over definitions and territories – and focus instead on what metascience is trying to achieve.

Second, metascience as a source of collective intelligence. This framing is particularly helpful from the perspective of governments, funding agencies, university leaders and others engaged in STI policy and system design. Geoff Mulgan defines collective intelligence as the capacity of groups to make good decisions by using a combination of human and machine capabilities.[84] It extends beyond individuals pooling their knowledge and expertise to encompass the emergence of intelligence from the interactions and synergies within a group. As another overview describes:

"*We can find collective intelligence in any system in which entities collectively, but not necessarily cooperatively, act in ways that seem intelligent. Often—but not always—the group's intelligence is greater than the intelligence of individual entities in the collective. These entities can be molecules, cells, biological organisms, computers, organizations, software components, or machine learning systems. They may perform tasks such as identifying phenomena, making predictions, solving problems, or taking actions.*"[85]

If we look again at Figures 3 and 5 above through this lens, we can see the outlines of a collective intelligence system at work: distributed, self-organised and highly contextualised expertise, enhanced by computational, AI and other methods, being directed towards deeper understanding of the inner workings of every inch of the scientific landscape. The challenge then for policy and funding becomes how to support and sustain the connections, aggregation and synthesis of this intelligence in ways that can inform strategy and prioritisation. And how to support infrastructures of various kinds which enable this.[86]

These two frames — metascience as a discourse coalition, and metascience as a source of collective intelligence – may help us to avoid the tendencies that can be so destructive of transdisciplinary modes of knowledge creation and system reinvention. As Michael Nielsen and Kanjun Qiu remind us in their 'Vision for Metascience':

82. Hajer, M.A. (1997) The Politics of Environmental Discourse: Ecological Modernization and the Policy Process, Oxford: Oxford University Press.
83. Montana, J., & Wilsdon, J. (2022). Analysts, advocates and applicators: three discourse coalitions of UK evidence and policy. Evidence & Policy, 18(3), 456-472. https://doi.org/10.1332/174426421X16112601473449
84. Mulgan G (2018) Big Mind: How Collective Intelligence Can Change Our World. Princeton, NJ: Princeton University Press.
85. Flack, J., Ipeirotis, P., Malone, T. W., Mulgan, G., & Page, S. E. (2022). Editorial to the Inaugural Issue of Collective Intelligence. Collective Intelligence, 1(1). https://doi.org/10.1177/26339137221114179
86. Hook, D. W., & Wilsdon, J. R. (2023). The pandemic veneer: COVID-19 research as a mobilisation of collective intelligence by the global research community. Collective Intelligence, 2(1). https://doi.org/10.1177/26339137221146482

"It is understandable that the people running funders and research institutions – often brilliant, imaginative people – will think they know just the right way to improve things. Yet the usual de facto outcome of such efforts is to centralize decision-making power, and so to suppress much of the messy, illegible potential latent in the community of scientists."[87]

Having mapped the landscape of UK metascience, our task now is to resist the temptation to pull out rulers and start drawing straight lines. We should continue to give both our Apollonian and Dionysian tendencies free rein.

Let's keep metascience plural and embrace its messiness; celebrate its history, while building its future.

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87. Nielsen, M. and Qiu, K. (2022). A Vision of Metascience: An Engine of Improvement for the Social Processes of Science https://scienceplusplus.org/metascience/

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