Response to the Global Consultation on the Draft Principles of Open Science Monitoring

Introducing Case Studies in Monitoring Open Science

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The Need for a Multi-dimensional Monitoring of Open Science

In this document we recognize the significance of the *UNESCO Recommendation on Open Science*, and the principles outlined by the Open Science Monitoring Initiative that guide this consultation. In line with these frameworks, we believe that the emphasis on inclusivity must underpin all Open Science (OS) efforts. From this perspective, we consider that the Principles of Open Science Monitoring can only gain further significance through specific implementation strategies, which is our focus in this response. In what follows, we propose a case-based approach for the monitoring of Open Science practices.

Following the development of policies to support Open Science (OS), there is currently a wave of efforts aimed at monitoring OS. As reported by the UNESCO's Open Science Outlook[1] in December 2023, most current monitoring focuses on tracking the creation of open research products, particularly Open Access publications, and to a lesser extent other open products such as datasets and software. Even if these monitoring approaches include access to journal articles and the reuse of datasets and software, they provide a narrow scope for how these and other open research practices can have broader impact towards global inclusivity as outlined in the *UNESCO Recommendation.*

There is a wide consensus that OS covers a variety of activities, including various forms of engagement and dialogue with societal actors, which foster sharing of knowledge for the benefit of science and society. There are numerous processes of participation and dialogue across the science system, which take different forms, operate at different scales, and often occur informally. Even if it were possible, only counting these processes would not necessarily serve as a particularly effective method of monitoring. Thus, it is crucial to have better data on participation and dialogue in OS monitoring.

If dimensions of participation and dialogue are not included in OS monitoring, they are likely to be overlooked because of the so-called 'streetlight effect'. This strategy could lead to substantial negative consequences, as it would result in an unbalanced OS development. As we have seen in research evaluation, focusing mainly on products has led to perverse incentives which have resulted in dysfunctional scientific behaviours and exacerbated inequalities in science within and across countries.[2]

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[1] UNESCO, 2023. Open science outlook 1: status and trends around the world. UNESCO. https://doi.org/10.54677/GIIC6829

[2] 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. R. Soc. open sci. 9, 211032. https://doi.org/10.1098/rsos.211032

In the next sections, we show how case studies can capture key dimensions that are elusive for exclusively indicator-based monitoring and align with the monitoring motivations and values behind the Principles of Open Science Monitoring.

Introducing Case Studies in Open Science Monitoring Systems

In its most general sense, a case study investigates a phenomenon in its real-life context. What we treat as a case here is the implementation of one or several OS practices (open databases, policies for open science, open access, collaborative research, library open science services, participatory and citizen science, open peer review) in a particular setting at a particular time. Our approach to case studies is agnostic regarding scale, as cases could range from highly institutionalised activities in transnational organisations to local, citizen-led, short-term initiatives. The use of case studies assumes that each situation can teach useful lessons around OS implementation, effectiveness, and impact.

A case study approach fosters a careful examination of what the degree of that implementation, effectiveness, and impact is in a particular context in relation to the participants involved. Additionally, this approach promotes understanding of the expected outcomes from the various actors' standpoints, and the challenges of that implementation and sustainability.

There have been several efforts to document in detail existing OS practices and initiatives through case studies - some of which are published[3], others in development[4]. Monitoring and extracting information from case studies would foster learning from this scholarship, as well as providing a scaffold for data gathering in future academic and non-academic efforts. This work could facilitate better cooperation across OS projects and the collection of 'lessons learned' in implementation.

The introduction of case studies in monitoring has two crucial advantages. First, it makes clear that the purpose of monitoring is not about competition or benchmarking but about learning how research systems can be improved with OS initiatives. Second, since case studies can identify key processes and pathways to impact makes it possible to describe why and how specific OS formats led to specific uses and benefits. These explanations overcome a blind spot of current monitors, which describe the outputs of the scientific system but cannot explain how those outputs were produced, if they were actually used, or whether they contributed to positive scientific or societal outcomes. Understanding outcomes is crucial to make evidence-informed decisions about where to invest resources in systems that are appropriate to a specific context - i.e. acknowledging the heterogeneity of OS rather than a 'one size fits all' approach.

We see case studies as part of a suite of monitoring methods. Surveys might also be useful as a complementary monitoring to existing methods, as shown for example regarding sharing of

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[3] Chan, L., Okune, A., Hillyer, R., Albornoz, D., Posada, A. (Eds.), 2019. Contextualizing openness: situating open science, Perspectives on open access. University of Ottawa Press, Ottawa; Levin, N., Leonelli, S., 2017. How Does One "Open" Science? Questions of Value in Biological Research. Science, Technology, & Human Values 42, 280–305. https://doi.org/10.1177/0162243916672071; Leonelli, S., 2023. Philosophy of Open Science, 1st ed. Cambridge University Press. https://doi.org/10.1017/9781009416368. EOSC (European Open Science Cloud) also provides a recent example of using case studies to track OS https://eoscfuture.eu/eventsfuture/eosc-future-use-case-event/, https://faircore4eosc.eu/case-studies

[4] Philosophy of Science for Diverse Research Environments Project case studies: https://opensciencestudies.eu/subprojects/

research materials[5], open peer review[6], policy use[7], engagement with non-academics[8], integrity[9], or broader perceptions and habits of OS[10].

The Use of Case Studies in Assessment Efforts

Case studies have previously been used in national exercises in monitoring and evaluation, precisely for the assessment of phenomena where not only research products, but processes and pathways to impacts were seen as important. The most prominent example is the United Kingdom's evaluation system (known as Research Excellence Framework (REF)), which uses case studies to assess research impact. This approach follows the agreement among experts that, given the diversity of pathways to impact, research cannot be meaningfully estimated only by quantitative indicators.

The UK has applied the impact case studies in the REF to assess research impact since 2014, and the methodology was developed building on three decades of experience in research evaluation.[11] Within that framework, a methodology to assess research impact centred on case studies was adopted based on a wide-ranging review of international methods for assessing research impact[12] and of an extensive pilot study.

Other examples of case study use for research assessment can be found in Hong Kong, Italy, and Australia. In Australia, an Evaluation Impact (EI) exercise was carried out for the first time in 2018 to assess university performance in each discipline using qualitative statements, a small suite of quantitative indicators for engagement, and a narrative based study for impact. In the Research Assessment Exercise (RAE) in Honk Kong, each submitting unit provides an impact overview statement, and one or more case studies describing specific examples of impacts achieved through a detailed narrative on impact achieved and the pathways leading to it as well as information on the research activities and stakeholders involved. In Italy, the National Evaluation Agency of HE and Research (ANVUR) applied case studies to assess the third mission of universities and research centres from 2020.

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[5] Shibayama, S., Walsh, J.P., Baba, Y., 2012. Academic Entrepreneurship and Exchange of Scientific Resources: Material Transfer in Life and Materials Sciences in Japanese Universities. Am Sociol Rev 77, 804–830. https://doi.org/10.1177/0003122412452874

[6] Squazzoni, F., Gandelli, C., 2012. Saint Matthew strikes again: An agent-based model of peer review and the scientific community structure. Journal of Informetrics 6, 265–275. https://doi.org/10.1016/j.joi.2011.12.005

[7] Cole, N.L., Reichmann, S., Ross-Hellauer, T., 2023. The potential of inclusive and collaborative Open Research processes at the science-policy interface. https://doi.org/10.31235/osf.io/qzmf6

[8] Lawson, C., Salter, A., Hughes, A., Kitson, M., 2019. Citizens of somewhere: Examining the geography of foreign and native-born academics' engagement with external actors. Research Policy 48, 759–774. https://doi.org/10.1016/j.respol.2018.11.008

[9] Schneider, J.W., Allum, N., Andersen, J.P., Petersen, M.B., Madsen, E.B., Mejlgaard, N., Zachariae, R., 2023. Is something rotten in the state of Denmark? Cross-national evidence for widespread involvement but not systematic use of questionable research practices across all fields of research. https://doi.org/10.31222/osf.io/r6j3z

[10] Ollé, C., López-Borrull, A., Melero, R., Boté-Vericad, J.-J., Rodríguez-Gairín, J.-M., Abadal, E., 2023. Habits and perceptions regarding open science by researchers from Spanish institutions. PLoS ONE 18, e0288313. https://doi.org/10.1371/journal.pone.0288313

[11] Bence, V., Oppenheim, C., 2005. The Evolution of the UK's Research Assessment Exercise: Publications, Performance and Perceptions. Journal of Educational Administration and History 37, 137–155. https://doi.org/10.1080/00220620500211189

[12] Grant, J., Brutscher, P.-B., Guthrie, S., Butler, L., Wooding, S., 2010. Capturing Research Impacts: A review of international practice. RAND Corporation.

Case studies have proven to be effective in assessing research impact. However some analysts[13] have highlighted some of the drawbacks of their application and elicited some critiques. First, in terms of operationalisation, conducting comprehensive case studies is both time-consuming and resource-intensive, requiring significant effort and expertise to gather detailed data, conduct interviews, and analyse information. Second, regarding empirical robustness, case studies can be subjective and exposed to bias, as they often rely on the viewpoints of those involved. Third, about the generalizability of case study findings, the results may not be applicable to other contexts or larger populations.

Further challenges are associated with the curation of case studies. For these studies to be more than proof of activity, they need to be responsibly curated and searchable. Therefore, there is a need for the development of FAIR data standards and controlled vocabularies to facilitate cross-case searches. As the case studies will vary considerably according to scope, time scale, context, language and culture developing and applying these vocabularies will involve considerable discussion.

Even with the development of FAIR data standards for case studies, challenges remain in the identification and long-term funding of repositories to host these case studies. These challenges relate to repository certification, data sovereignty and control of curation, all of which raise questions of where data should be stored and who should be the gatekeepers for inclusion into databases of case studies.

In spite of these limitations, case studies have been shown to be useful in research assessments which concern processes and outcomes and face a diversity of contributions that cannot be captured by a small set of indicators. It is important to remember that the use of quantitative indicators is also the result of particular choices. Regarding generalisation from the perspective of case studies, it is not towards 'populations or universes' but towards dimensions of the phenomena under examination across contexts, that case studies aim to capture key processes and pathways. Finally, the more case studies, the more sense of common threads and clusters we create, on dimensions that cannot be analysed or even identified otherwise.

Draft Template for Open Science Case Studies and Pilot Implementation

Considering the emphasis of case studies on contextuality and uniqueness, the ability to treat cases as "comparable instances of the same general phenomenon"[14] requires an analytical template to the various elements of the case study. We propose the following dimensions:

[13] Farla, K., Simmonds, P. 2015. REF Accountability Review: Costs, benefits and burden Report by Technopolis to the four UK higher education funding bodies.
https://www.technopolis-group.com/report/ref-accountability-review-costs-benefits-and-burden/
[14] Ragin, C.C., Becker, H.S. (Eds.), 1992. What is a case? exploring the foundations of social inquiry. Cambridge University Press, Cambridge [England] ; New York, NY, USA.

1. Name of the organisation/initiative	
2. Country	
3. Sector	
4. Subsector	
5. Open science practices	5.1.Open scientific knowledge (publications, research data, educational resources, open source software and source code, open hardware); 5.2. OS infrastructures (virtual and physical); 5.3open engagement of societal actors (crowdfunding, crowdsourcing, scientific volunteering, citizen and participatory science); 5.4.open dialogue with other knowledge systems (indigenous peoples, marginalised scholars, local communities) 5.5.Other
6. Main activities	
7. Motivations	
8. Associated Sustainable Development Goals	8.1. No poverty 8.2. Zero hunger 8.3. Good health and well-being 8.4. Quality education 8.5. Gender equality 8.6. Clean water and sanitation 8.7. Affordable and clean energy 8.8. Decent work and economic growth 8.9 Industry, innovation and infrastructure 8.10. Reduced inequalities 8.11. Sustainable cities and communities 8.12. Responsible consumption and production 8.13. Climate action 8.14. Life below water 8.15. Life on land 8.16. Peace, justice, and strong institutions 8.17. Partnerships for the goals
9. Objectives	
10. Date of implementation	
11. Is this a fixed-term organisation/initiative?	
12. If the answer in (11) is yes, until when is the initiative active?	
13. Key Outputs	
14. Expected outcomes and impacts	
15. Deviations from the original plan	
16. Unexpected outcomes and impacts	
17. Key participants	
18. Modes of engagement with external actors	
19. Is this in response to a specific regulatory framework?	
20. Funding source	Local National International
21. Long-term sustainability concerns	
22. Other challenges	
23. One success story of your work	
24. Keywords	

The goal of this template is to combine multiple-choice answers in the format of drop-down menus with an open narrative in which the various organisations or initiatives can describe their practices and challenges. This narrative aspect is central to the extent it gives those involved in populating the template an opportunity to reflect on their activities, and on their challenges in achieving the expected outcomes. These reflections are crucial to grasp dimensions of participation as an always emerging process. Through thematic analysis of all content, it will be possible to collate these data to track activities at various levels.

We are undertaking a pilot implementation of this template with the case studies in the project Philosophy of Open Science for Diverse Research Environments. The project, led by Sabina Leonelli, is funded by the European Research Council, and is based at the Technical University of Munich in Germany and the University of Exeter in the United Kingdom. The project centres on the diverse ways in which OS is enacted around the world and articulates the conditions under which it can leverage such diversity to promote good research practice.

The project is structured around case studies[15] that examine practices like data crop management, citizen science, global healthcare, data-intensive space biology, ecology, and modes of governance of large databases and/or citizen science initiatives in India, Ghana, Greece, the United States, Brazil, the UK, and Italy. The research team uses qualitative methods that include the analysis of publication records, data-sharing policies, and implementation strategies; interviews; surveys; participant observation and participative engagement collaborating with the organisations. All studies are conducted in collaboration with the scientific organisations at hand, and the analysis of cases combines historical, philosophical and social scientific perspectives. As part of this collaborative approach, the project team will prompt partners to participate in the use of - and feedback on - the template proposed above.

This project is an example of interdisciplinary collaborative qualitative work on cases currently carried out in academia. From there, we see the potential to harness such work in a way that is comparable and can speak to policy concerns. Thus, we propose to use findings from these case studies to populate the template and conduct a cross-case analysis in order to track the impact of OS practices in these settings and, as described above, identify the processes and pathways to this impact. Given the fact that these case studies are also the subject of detailed qualitative investigation it will be possible to cross-check and assess the organisation's response to the template and the degree of detail provided in their interaction with the template.

In sum, we consider that OS monitors could and should be enriched with the inclusion of case studies. Given that OS is about the transformation of the research system[16], it is no surprise that it also needs new concepts about what a monitoring framework is. We see that the diverse implementations of the Open Science Monitoring Initiative provide a unique opportunity to enact this change.

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[15] Leonelli, S., Castaño, P., Trappes, S. et al. 2023. A Philosophy of Open Science for Diverse Research Environments https://opensciencestudies.eu/wp-content/uploads/Poster_PhilOS-2024-A0_landscape-compressed.pdf

[16] Rafols, I., Meijer, I., Molas-Gallart, J., 2024. Monitoring Open Science as transformative change: Towards a systemic framework. F1000Res 13, 320. https://doi.org/10.12688/f1000research.148290.1