



Open Science as Part of Research Culture

Positioning of the German Research Foundation

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1 Preliminary Remarks

The Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) considers open science as scientific practices and processes that are established or designed to make research results openly accessible for the long term, thereby ensuring an increased uptake of these results by researchers and other stakeholders. The DFG regards open science as a consequence of the digital transformation¹ of research processes, which has essential functions in the practice of research. The DFG's engagement of shaping open science is in terms of DFG's role and responsibilities within the research system.²

As the central self-governing research funding organisation in Germany, DFG funds research of the highest quality, strengthens the national research system through strategic funding initiatives, and shapes appropriate framework conditions and standards to enable curiosity-driven research. When implemented in a science-serving manner, open science can promote these goals by optimising research processes, facilitating the re-usability of research results, stimulating discourses within science and the humanities, increasing the transparency of science towards society and strengthening trust in research and scholarship.

With regard to open science, the DFG seeks to shape the relevant framework, while taking into account the needs and requirements of the scientific community. The DFG supports researchers and research infrastructures in establishing and applying open science practices.

The DFG is committed to the further development of principles and practices of open science based on a balanced view of its potential and challenges for research and scholarship. The UNESCO *Recommendation on Open Science*³, which are reflected within this positioning, provide an essential basis for the further development of open science in an international context. At the European level, a framework is provided by the Council Conclusions on Research Assessment and Implementation of Open Science.⁴

¹ On the digital transformation and digital change in general, see [Deutsche Forschungsgemeinschaft: *The Digital Turn in the Sciences and Humanities*](#).

² Deutsche Forschungsgemeinschaft: *Rolle und perspektivische Entwicklung der Deutschen Forschungsgemeinschaft im deutschen Wissenschaftssystem. Positionspapier des Präsidiums der DFG*, 2022, www.dfg.de/download/pdf/dfg_im_profil/geschaeftsstelle/publikationen/stellungnahmen_papiere/2022/220629_positionspapier_rolle_entwicklung_dfg.pdf.

³ UNESCO: *UNESCO Recommendation on Open Science*, 2021, <https://unesdoc.unesco.org/ark:/48223/pf0000379949.locale=en>.

⁴ Council of the European Union: *Council Conclusions on Research Assessment and Implementation of Open Science*, 10126/22, 2022, www.consilium.europa.eu/media/56958/st10126-en22.pdf.

2 Open Science from the DFG's Perspective

Open science has an enabling impact on research and scholarship in that it makes research results openly accessible for the long term, thereby ensuring a better uptake of these results by researchers as well as by other stakeholders. Open science practices should be aligned with discipline-specific needs and in must contribute to improve research processes and to accelerate access to information, therefore enabling the advancement of knowledge and an increased reproducibility of methods and results.

Aspects relevant to ensuring that open science is advantageous to research and scholarship include open access to and legally protected re-use of publications and research data, and also – if possible and reasonable – research and infrastructure software (open code). It is equally important that the infrastructures involved are designed according to principles of openness and do not lead to lock-in effects, i. e. infrastructural dependencies on specific providers.

The term open science places high expectations on research and scholarship. In order to be able to meet these expectations, awareness must be raised of the fact that in the context of open research, all actors – researchers, infrastructural institutions and data intermediaries⁵ – have a greater responsibility with regard to the selection of platforms for publication as well as for the curation of research data, metadata and contextual information. Users have a greater responsibility with regard to the search, navigation, legally protected re-use, verification and interpretation of freely accessible information. These prerequisites must be developed and ensured, as open science is expanded at all levels, from individuals to institutions. This requires appropriate training and education measures, but also incentive and support structures within the academic environment.

The DFG is fundamentally committed to open access to (academic) publications, research data and metadata, the openness of research and infrastructure software and – where appropriate – that of research processes. At the same time, the DFG does not consider full openness of the entire research process and all processes of quality assurance and research assessment to be purposeful. It can be beneficial to research and scholarship if, for example, a protected space is guaranteed for academic discourse or with regard to the peer review and assessment of projects. Furthermore, (contractual) legal considerations and intellectual property rights, for example, can also play a limiting role in this connection. Weighing up the degree of openness becomes inevitable if necessary critical discourses or objective debates are otherwise suppressed due to the openness of a given process, or where conflicts over subject matter and scientific controversies arise in the public sphere in such a way that they can potentially damage individuals and have detrimental consequences for them. Likewise, it should also be considered that complete and

⁵ Term taken from the proposal for a Data Governance Act: European Commission: *Proposal for a regulation of the European Parliament and of the Council on European Data Governance (Data Governance Act)*, COM/2020/767, 2020, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020PC0767>.

unregulated transparency of all research processes and data may unintentionally enable undesirable surveillance mechanisms – whether by commercial, governmental or supranational actors.

3 Enabling Factors of Open Science

Open science is a way of applying the fundamental aspirations of research and scholarship, in particular the need for the free circulation of knowledge, in the digital age. When shaping open science, the underlying conditions that enable the functioning of research and scholarship must be taken into account. At the same time, framework conditions have to be adapted and shaped for the future so that open science can become a reality in a way that is beneficial for research and scholarship.

First, the preservation of academic freedom remains a basic condition that applies equally to open science. Guidelines for open science must not be restrictive here.

Second, good research practice has to be considered as a framework condition for open science. Open science is one form of implementing good research practice⁶ and facilitates its realisation, e. g. by making results verifiable. But good research practice goes beyond open science by incorporating additional aspects. In this way, open science can contribute to good research practice, but it can neither guarantee nor replace it.⁷

Third, open science raises relevant organisational questions: if the public funding of research can be considered an argument for making its results accessible to the general public, it follows on from this, that science-led governance should also be provided for open science infrastructures, and that the decisions regarding these infrastructures should be taken by the academic community.

Fourth, applicable legislation must be taken into account, which is relevant in various contexts, and which the DFG is helping to shape, e. g. with regard to access to clinical data.⁸

Taking these key framework conditions into account, the DFG considers open science to offer the following opportunities for research and scholarship:

- ▶ **It enables the improvement of research processes.** The quality of research can be improved when, based on openly accessible information, established discipline-specific quality assurance processes become even more effective.⁹ Additional appropriate methods for quality assurance and to avoid of misinterpretation need to be developed and applied.

⁶ [Deutsche Forschungsgemeinschaft: Good Research Practice](#)

⁷ European Research Area and Innovation Committee (ERAC): *ERAC SWG OSI Guideline Report on Research Integrity and Open Science*, ERAC 1207/21, 2021, <https://data.consilium.europa.eu/doc/document/ST-1207-2021-INIT/en/pdf>.

⁸ One example here is legal limitations to accessing medical data (contributions by the Senate Commission on Key Questions in Clinical Research, SGKF).

⁹ Knowledge Exchange: *The Art of Publishing Reproducible Research Outputs: Supporting emerging practices through cultural and technological innovation*, 2021, Zenodo, <https://doi.org/10.5281/zenodo.5521077>.

- ▶ **Increased transparency regarding the replication of research.** The existing potential for addressing, for example, replication problems should be actively exploited by researchers. Open science will not automatically solve replication crises, but can establish better conditions for avoiding them.
- ▶ **Equal access to research information is supported** and access to information is simplified. While open science can facilitate equitable participation in the global science system, it cannot provide such equity by itself. Factors external to science that inhibit access opportunities are not offset by open science.
- ▶ **Strengthening of research cooperation** can be achieved through open science by facilitating interdisciplinary and multidisciplinary collaborations, e. g. by removing domain barriers, thereby enabling the participation of otherwise excluded actors. This requires results and information to be curated according to FAIR principles¹⁰, and meta- as well as research data and other content to be interpretable across disciplines.
- ▶ **Innovation is facilitated** because, ideally, open science creates improved conditions for bringing together findings from different areas of fundamental research and transferring these into application-oriented settings.

The following challenges must be considered when implementing open science across the board:

- ▶ Open science may be propagated as a panacea and an ideology, thus bearing the risk of neglecting associated adverse effects such as price increases in the publication sector and the dependence of research on proprietary services by large corporations.
- ▶ The amount of information generated by scientific research will increase even more rapidly than before: but even under these circumstances, comprehensive quality assurance must remain guaranteed. In addition, suitable selection concepts are needed, since not all (digital and open) information needs to be stored on a long-term basis – in accordance both with scientific and ecological sustainability requirements. These concepts have to be developed by the scientific communities.
- ▶ The increasing commercialisation of research processes (i. e. publications, research data, software and digital tools), which the DFG regards as problematic, will not be automatically prevented by the fact that such processes are open. Additional safeguards will be needed with regard to science-led governance structures and management guidelines of infrastructures.
- ▶ Misguided incentives are likely to be reinforced if an immediate, broad impact of research results is confounded with scientific quality: This could result in inappropriate incentive structures to be embedded into assessment procedures, or to (mis-)guide funding

¹⁰ FAIR principles: This term refers to digital information being discoverable, accessible, interoperable and re-usable, see FORCE11: *The FAIR Data Principles*, 2016, <https://force11.org/info/the-fair-data-principles>.

decisions. For example, societal benefit of potential research results or strong interest by third parties cannot be the sole proof of quality when assessing fundamental research.

4 Open Science for Society and the Economy

Open science also entails changes in the relationship between science and society and between science and the economy.

For open science to serve society, it is fundamental that publicly available results are interpretable and reproducible and that science communication also meets the increased demands in terms of explanation and interpretation of research results due to their wider availability. In this way, the value of data can be safeguarded and trust in reliable research can be achieved. However, it must be made clear that research is a process which, although carried out according to rules and principles of quality assurance, can still produce outcomes and subsequent conclusions that may turn out to be provisional or indeed incorrect.

Open science also facilitates the involvement of civil society in research processes (citizen science) and therefore a broadening of the knowledge base and a greater diversity of perspectives. Citizen participation in science however should not be an end in itself, and decisions on its specific nature and extent should always remain a responsibility of researchers.

Open science can act as a key factor in the emergence of innovations and in the transfer of knowledge into applications, providing research results are made openly available to industry. However, science does not currently benefit to the same extent from corporate (research) data as long as this data remains inaccessible in contrast publicly-funded research data. It is therefore to be welcomed that, for example, EU legislation like the EU Digital Markets Act and Digital Services Act, will also promote scientific re-use of data from industry.

5 The DFG's Fields of Activity in Connection with Open Science

The realisation of open science is a task that is to be pursued across research systems and countries. The DFG contributes to shaping appropriate framework conditions in order to enable the German research system to harness the opportunities offered by open science. The DFG funds the implementation of open access and the development of (publication, data and software) infrastructures for open science. In addition, the DFG participates in national and international fora on the further development of open science, and is contributing to the development of the German National Research Data Infrastructure (NFDI, Nationale Forschungsdateninfrastruktur) and the European Open Science Cloud (EOSC). The DFG supports the “Action Plan for Diamond Open Access” and therefore the science-driven development of publication infrastructures.

The DFG regards open science as an integral part of the overarching discourse on research culture¹¹. Open science, as being part of good scientific practice¹², is not only facilitating the advancement of knowledge but also processes of quality assurance, reproducibility and replicability.¹³ With regard to research evaluation, the DFG is guided by the San Francisco Declaration on Research Assessment (DORA)¹⁴ and has recently comprehensively outlined its position on the assessment of research based on publications.¹⁵ The DFG is also involved in the European initiative “Coalition for Advancing Research Assessment” (CoARA)¹⁶ to promote open science as part of a positive research culture.

The further realisation of open science is not an end in itself: it can only succeed by adhering to the fundamental values that underpin science and research. The DFG's statutory bodies will observe ongoing developments regarding open science in the different academic disciplines, and will decide on the adjustment of funding policies and framework conditions, e. g. on assessment practices or the legitimacy of mandatory open access publication.

¹¹ Global Research Council: [GRC Publications](#); Science Europe: *Research Culture. Empowering researchers with a thriving research system integrated in society*, 2021, Zenodo, <https://doi.org/10.5281/zenodo.5726893>; Science Europe: *A Values Framework for the Organisation of Research*, 2022, Zenodo, <https://doi.org/10.5281/zenodo.6637848>.

¹² [Deutsche Forschungsgemeinschaft: Good Research Practice](#)

¹³ A DFG Statement on the replicability of research was published in 2017: Deutsche Forschungsgemeinschaft: *Replicability of Research Results. A Statement by the German Research Foundation*, 2017, www.dfg.de/download/pdf/dfg_im_profil/geschaeftsstelle/publikationen/stellungnahmen_papiere/2017/170425_stellungnahme_replizierbarkeit_forschungsergebnisse_en.pdf.

¹⁴ <https://sfdora.org/>

¹⁵ Deutsche Forschungsgemeinschaft: *Academic Publishing as a Foundation and Area of Leverage for Research Assessment. Challenges and Fields of Action*, 2022, Zenodo, <https://doi.org/10.5281/zenodo.6538163>.

¹⁶ [Directorate-General for Research and Innovation: Reforming research assessment: The Agreement is now final](#), 20.07.2022.

6 Conclusion

Open science relates to the entire cycle of research activities. The DFG supports open science as a way to optimise knowledge-driven research processes. Realisation of the potential of open science depends essentially on values that constitute science such as diligence, impartiality and other ethical principles of scientific practice¹⁷. Open science cannot substitute these values. Meanwhile, the increased availability of research results due to open science practices allows for a more rapid and wider dissemination of shortcomings and flaws in research processes. For the sake of academic integrity, these deficiencies need to be addressed properly as part of quality assurance mechanisms in research.

In addition, digital and infrastructural sovereignty of science is playing an increasing role. Science must aspire to shape the digital transformation and open science in a way that preserves its autonomy.¹⁸ This requires scientific institutions or bodies to be involved in the governance of infrastructures in order to have an influence on their organisational structure and development.

Wherever open science appears to be primarily politically motivated, this can give rise to developments that are detrimental to research and scholarship. If open science becomes a goal in itself and no longer primarily serves to improve research processes, science must identify, address and minimise such negative effects within the framework of its own self-governance system. This also includes setting distinct developments in relation to each other and evaluating their consistency, such as observing how research and publication practices relates to the assessment of research performance.¹⁹ For this reason, the DFG is opposed towards transforming research assessment systems with the aim to impose open science as an end in itself. Rather, changes to evaluation procedures must adequately support research aimed at advancing knowledge as well as enabling an appropriate assessment of individuals and projects based on reasoned statements regarding their potential and quality. Open science has the potential to play an important role in this regard, but will not by itself become a guarantee of higher quality in research.

Science and research funding actors have the responsibility to unlock the potential of open science. At the same time, it is important to address pertaining challenges in an unbiased manner to safeguard the inherently beneficial and forward-looking concept of open science. In this regard, the DFG will continue to shape the necessary framework conditions based on the principle of self-governance of its statutory bodies.

¹⁷ [Deutsche Forschungsgemeinschaft: Good Research Practice](#)

¹⁸ Konrad, U., Förstner, K., Reetz, J., Wannemacher, K., Kett, J., Mannseicher, F.: *Digital services for science – where is the journey heading?* 2020, Zenodo, <https://doi.org/10.5281/zenodo.4301947>, p. 5.

¹⁹ Deutsche Forschungsgemeinschaft: *Academic Publishing as a Foundation and Area of Leverage for Research Assessment. Challenges and Fields of Action*, 2022, Zenodo, <https://doi.org/10.5281/zenodo.6538163>.



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