

## The Beijing Declaration on Research Data

### Preamble

Grand challenges related to the environment, human health, and sustainability confront science and society. Understanding and mitigating these challenges in a rapidly changing environment require data<sup>i</sup> to be FAIR (Findable, Accessible, Interoperable, and Reusable) and as open as possible on a global basis. Scientific discovery must not be impeded unnecessarily by fragmented and closed systems, and the stewardship of research data should avoid defaulting to the traditional, proprietary approach of scholarly publishing. Therefore, the adoption of new policies and principles, coordinated and implemented globally, is necessary for research data and the associated infrastructures, tools, services, and practices. The time to act on the basis of solid policies for research data is now.

The Beijing Declaration is intended as a timely statement of core principles to encourage global cooperation, especially for public research data. It builds on and acknowledges the many national and international efforts that have been undertaken in the policy and technical spheres on a worldwide basis.<sup>ii</sup> These major contributions are listed in the Appendix.

Several emergent global trends justify and precipitate this declaration of principles:

- Massive global challenges require multilateral and cross-disciplinary cooperation and the broad reuse of data to improve coherence concerning recent UN landmark agreements, such as the Paris Climate Agreement, the Sendai Framework for Disaster Risk Reduction, the Sustainable Development Goals (SDGs), the Convention on Biological Diversity, the Plant Treaty, the World Humanitarian Summit, and others. The comprehensive agendas for action provided by these agreements requires access to and reuse of all kinds of data.
- Research and problem-solving, especially addressing the SDG challenges, are increasingly complex and driven by ‘big data’, resulting in the need to combine and reuse very diverse data resources across multiple fields. This poses an enormous challenge in the interoperability of data and responsible stewardship, with full respect for privacy.
- Rapid advances in the technologies that generate and analyze data pose major challenges concerning data volume, harmonization, management, sharing, and reuse. At the same time, emerging technologies (including machine learning) offer new opportunities that require access to reusable data available in distributed, yet interoperable, international data resources.
- Changing norms and ethics encourage high-quality research through greater transparency, promote the reuse of data, and improve trustworthiness through the production of verifiable and reproducible research results. Increasing the openness of research data is efficient, improving the public return on investment, and generating positive externalities.
- Open Science initiatives are emerging globally, including in less economically developed countries. There consequently are opportunities for these countries to take advantage of technological developments to develop a greater share in scientific production. Without determined action, there is also a risk that the divide in scientific production will widen.

In September 2019, CODATA and its Data Policy Committee convened in Beijing to discuss current data policy issues and developed a set of data policies adapted to the new Open Science paradigm. The Declaration proposed below is the result of that meeting and is now put forward for public review.

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<sup>i</sup> In this document we deliberately use the word data very broadly, to comprise data (*stricto sensu*) and the ecosystem of digital things that relate to data, including metadata, software and algorithms, as well as physical samples and analogue artefacts (and the digital representations and metadata relating to these things).

<sup>ii</sup> Europe has been an early mover with its ambitious plans for a European Open Science Cloud, which also has prompted discussions and declarations in many other countries. A collection of major statements of policy principles is listed in the Appendix.

## The Beijing Declaration on Research Data

The Beijing Declaration supports international efforts to make research data as open as possible and only as closed as necessary. It seeks to make data and metadata Findable, Accessible, Interoperable, and Reusable (FAIR)<sup>iii</sup> on a global basis and, wherever possible, automatically processable by machines. Although this Declaration is relevant mostly for research data that are generated through public funding, there are also instances in which privately funded data are made broadly available, in which case these principles would also apply. In addition, data not initially generated for research may be used in research at a later stage. The Beijing Declaration endorses many existing research data policies and management practices that have been promoted by previous declarations and statements, and they are included as references in the Appendix. The participants in the September 2019 policy meeting have produced the following set of ten principles:

1. **Research is increasingly driven by data** that are beyond human processing alone. Researchers therefore should have access to diverse, trustworthy, and reusable sources of data that are readily available and machine actionable. Data stewardship capacity building and comprehensive policies that enable the creation, dissemination, preservation, and above all the **global reuse of data and information** are essential, including sustained support for the required infrastructure and expertise.
2. **Research data have global public good characteristics.** A pure public good cannot be depleted by use (also called non-rivalrous) and cannot be excluded from use. Research data cannot be depleted, but can be restricted in use, although exclusion of reuse by others can be very inefficient and controversial, especially if the data are generated by public funding. **The value of research data increases with use.**
3. Publicly funded research data should be **findable** online to build an **international data commons**. Findable data require comprehensive metadata descriptions and persistent identifier tags, because data that cannot be easily located by potential users—whether by humans or machines—are of limited value. Together, principles three to seven result in “**FAIR**” data (data that are Findable, Accessible, Interoperable, and Reusable)—both for machines and humans.
4. Publicly funded research data are, by default, **in the public interest and should be accessible to the greatest extent possible for international reuse**. They were created or collected on behalf of the public that paid for them, and thus should be **as open as possible and only as closed as necessary**. This is even more important in cases where the data relate to issues covered by the UN landmark agreements.
5. Publicly funded research data should be **interoperable, and preferably without further manipulation or conversion**, to facilitate their broad reuse in scientific research.<sup>iv</sup> Software, instruments, and data formats should be well-documented and should not impose any proprietary lock-in that restricts reuse. Data should be described with rich metadata and should use community-recognized terminologies to maximize interoperability and reuse.
6. Despite strong reasons for making research data as open as possible, there are **legitimate reasons to restrict access to and reuse of data**, including interests of national security, law enforcement, privacy, confidentiality, intellectual property, and indigenous data governance, among others. Restrictions should have an express justification and research data **otherwise should be open by default on a global basis**. If the data need to be closed, an effort should be made to provide responsible and proportionately controlled access.
7. **National legislation** that exempts research data from copyright or other intellectual property (IP) protections is one way to enable and support reuse of public data. Another way is for researchers to choose a minimally restrictive and **voluntary common-use license**<sup>v</sup>.
8. Funders of academic and applied research should require the **submission of adequate data stewardship plans**, including clear guidelines for the provision of long-term availability, accessibility, and conditions for reuse. Open data policies should be accompanied by commensurate penalties for noncompliance as well as appropriate incentives.
9. **Activities that address the “divide in scientific production”** between less economically advanced regions and those economies with advanced research infrastructures should include access to publicly funded research data and related information. The wider deployment and access to advanced technical research infrastructures is a necessary, but not sufficient, condition to reduce the divide.
10. **Research data policies should promote the principles in this Declaration and be coordinated internationally.** They should be implemented with clear policy wording and guidelines, specific funding, and a commitment to monitor their impact with the overall objective of building a global FAIR data commons.

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<sup>iii</sup> Wilkinson et al 2015, DOI: 10.1038/sdata.2016.18

<sup>iv</sup> Interoperability of data has technical, semantic, and legal components—all of which need to be addressed successfully to make the data fully reusable.

<sup>v</sup> Common-use licenses (such as a Creative Commons CC-BY license or CC0 public domain waiver) preserve some ownership rights while providing access to and reusability of the data. Giving appropriate credit to data providers is essential for promoting data sharing.

## Appendix

### A Selection of Previous Statements and Declarations of Principles on Research Data Policy

1. Australian Code for the Responsible Conduct of Research <https://www.nhmrc.gov.au/about-us/publications/australian-code-responsible-conduct-research-2018> and a set of supporting guidelines including one for Management of Data and Information in Research <https://www.nhmrc.gov.au/file/14359/download?token=0FwepbdZ>
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3. Budapest Open Access Initiative. Open Society Foundations. 14 February 2002. Available at: <https://www.budapestopenaccessinitiative.org/read/>
4. CARE Principles of Indigenous Data Governance <https://www.gida-global.org/care>
5. Committee on Data for Science and Technology (CODATA) Data Sharing Principles in Developing Countries. Data Sharing Principles in Developing Countries. CODATA. 30 July 2015. Available at: <https://zenodo.org/record/22117#.XYxiL0YzY2w>
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9. Declarations in Support of OA (Open Access). Available at: <http://tagteam.harvard.edu/hubs/oatp/tag/oa.declarations>
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16. G8 Open Data Charter. UK Cabinet Office. 18 June 2013. Available at: <https://www.gov.uk/government/publications/open-data-charter/>
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