

Open Science Practice in Clinical and Biomedical Research

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I think everyone, from every government, policymakers, international and national stakeholders to many scientists, clinical and biomedical researchers need a clearer direction about the values and principles of Open Science (OS). This article is motivated following my recent participation in the International Training Workshop on Open Science and SDGs in Beijing, China from 28th August to 8th September 2023. A note of sincerest thanks and gratefulness to Chinese Academy of Sciences (CAS) [<https://english.cas.cn/>], Committee on Data of the International Science Council (CODATA) [<https://codata.org/>] and their international collaborators who had chosen me to be worthy of the sponsorship out of more than 300 international applicants.

Open Science (OS) [1] is defined as an inclusive construct that combines various movements and practices aiming to make multilingual scientific knowledge openly available, accessible and reusable for everyone, to increase scientific collaborations and sharing of information for the benefits of science and society, and to open the processes of scientific knowledge creation, evaluation and communication to societal actors beyond the traditional scientific community [**Appendix 1: UNESCO's Open Science Diagram**]. It comprises all scientific disciplines and aspects of scholarly practices, including basic and applied sciences, natural and social sciences and the humanities, and it builds on the following key pillars: open scientific knowledge, open science infrastructures, science communication, open engagement of societal actors and open dialogue with other knowledge systems [**Appendix 2: UNESCO's Open Science Domains**].

Malaysian Open Science (MOS) Platform (<https://mosp.gov.my/>) is in existent since last year promoting open access of data and publication in the country [2,3]. The MOSP initiative was approved and endorsed by the Malaysian Cabinet on the 14 Aug 2020 (<https://mosp.gov.my/about>). However, the culture of data sharing was not well received with < 20% were openly shared [4]. The different concerns expressed by the researchers included misuse of data by others (23%), misinterpretation of data (21.3%), lack of appropriate policies and rights protection (21.3%), legal and ethical issues (18.9%), fear of losing scientific edge (10.7%) [4]. Hence, much support is required in the data management and data stewardship from others than the researchers themselves to enable the data sharing practice, beside improving awareness, understanding and confidence in OS practices, and having sound policy, services and stable infrastructures [**Appendix 3: UNESCO's Promoting Open Science**].

Truly, OS is more than just data sharing. This is well explained and supported by the OS Framework (OSF) [5].

"The OSF is a free open-source software project that facilitates open collaboration in science research. As a collaboration tool, OSF helps research teams work on projects privately or make the entire project publicly accessible for broad dissemination. As a workflow system, OSF enables connections to data, preprints, and data management and research planning that researchers already use, streamlining their process and increasing efficiency. Post your work, solicit feedback, and tag categories for others to find, comment on, and engage with you."

This is in line with the UNESCO Recommendation on Open Science that OS is the practice of science as in the scientific clinical and biomedical research that it is 'opened' from the beginning to the end throughout the whole research process [1,5]. This includes sharing research protocols, making public research tools, involving public and patient in the research planning [6,7], transparent in the research undertakings, collaborative with experts and conduct high-quality research with integrity. An example of this was previously shared by AP Dr. Subapriya Suppiah from a radiologist's perspective [8]. You may want to explore the Tips and Tricks about the OSF on how to best practice OS in your next research project (<https://help.osf.io/article/576-tips-and-tricks>):

- Tip 1: Metadata For Improving Discoverability, Sharing, Collaboration, And Reuse Of Your Work
- Tip 2: Connecting PIDs For A Persistent Complete Research Story
- Tip 3: Finding And Reusing Data On A Generalist Repository
- Tip 4: Evaluating Data Viability
- Tip 5: Getting To Know The OSF: The Basics
- Tip 6: Connecting Your Research Tools On The Open Science Framework
- Tip 7: Get The Most Out Of Your OSF Preprint

Additional challenges of practising OS include compatibility of OS with intellectual property rights [9] and sustainability of OS [10]. OS is to be as open as possible so that all stakeholders can appreciate its full meaning and benefit from science via the FAIR (findable, accessible, interoperable and reusable) principles [11], but at the same time be as close as possible to the local problems, values, cultures and legal requirements via the CARE (collective benefit, authority to control, responsibility and ethics) principles [12]. OS does not mean indiscriminate openness, and consent of or licence to use any open sources of research product must first obtain permission from the intellectual property rightsholder. The similar goes to potential rightsholders to advocate use of copyright and licence to force the openness of your free research/scientific products.

OS does not mean free of cost. The initial shift to OS may require some investments on the infrastructures and capacity building, and likely similar operation costs to maintain them. However, with the OS practice, science will yield multiple returns on the investment from accelerated of high-quality research, innovation and commercialisation **[Appendix 4: UNESCO's Values and Principles of Open Science]**.

Lastly, I call upon every clinical and biomedical researcher, every administrator of research institution and centre to promote OS, to support OS initiatives and to practice OS as outlined by this article. You can consider the Center for Open Science's system-wide effort through the Theory of Change strategy [<https://www.cos.io/impact>] to proactively reform the scientific practice in your research, norms and reward system in your institution, and to elevate rigor, transparency, sharing, and reproducibility of research products as the emerging culture.

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Appendix 1: UNESCO's Open Science Diagram



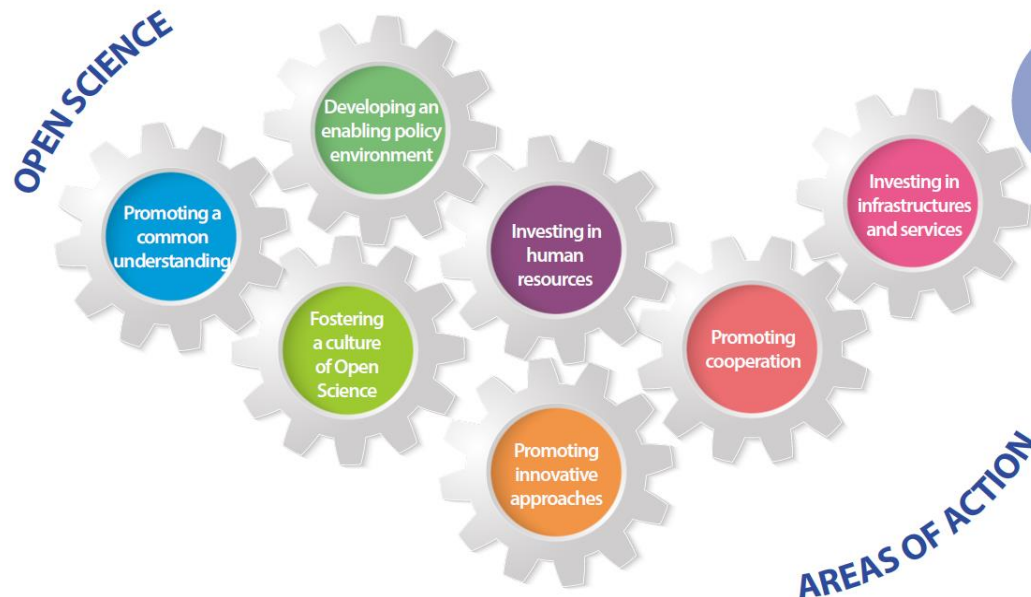
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Appendix 2: UNESCO's Open Science Pillars



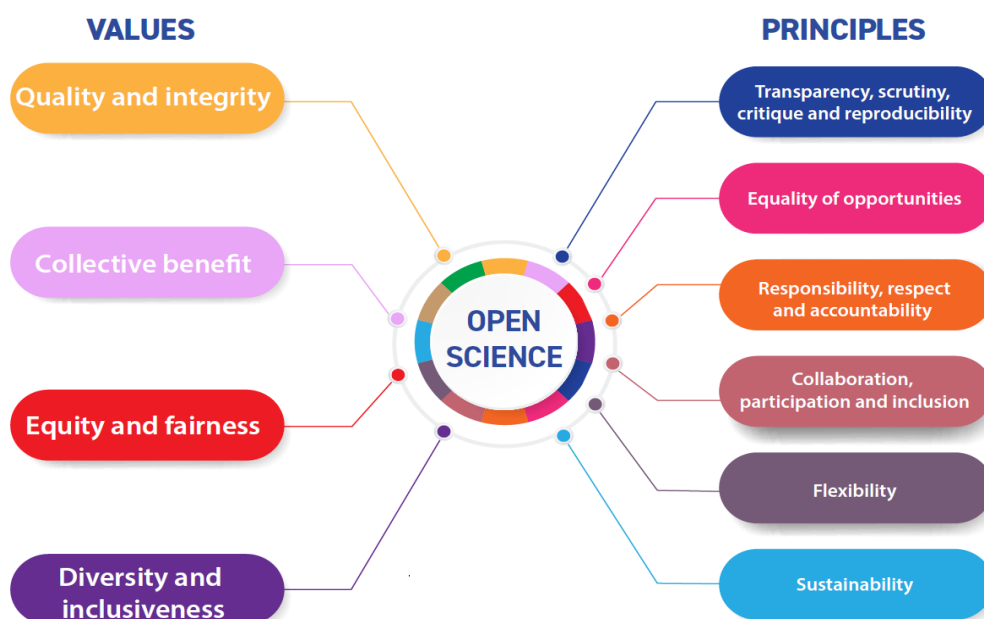
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Appendix 3: UNESCO's Promoting Open Science



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Appendix 4: UNESCO's Values and Principles of Open Science



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