

The benefits of Open Science:

Evidence for claims made in the NWO animation on “Open Science”



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The Dutch Research Council (NWO) has been a strong supporter of Open Science for many years. In 2020 we commissioned the production of a very short (1.30 minute) animation to explain what Open Science is about and why NWO thinks it is so important. The video can be viewed on the NWO website: www.nwo.nl/openscience. In this document we provide the references to scholarly literature that support the claims made in the video about the benefits of Open Science.

“Open access publications are more visible, easier to find and thus get cited more”.

There is a large body of knowledge that studied the effect of open access availability of publications on the use of those publications in terms of readership and **citations**. The so-called “citation advantage” (open access articles are cited more often than equivalent closed access articles) has been reported first in 2001 (Lawrence, 2001). Although there have been studies that questioned this citation advantage (Davis, 2011), the general understanding is that open access papers do in fact gain more citations than those behind paywalls and reach a considerably broader readership.

There have been several bibliographic studies that have attempted to bring together the research on the topic. Swan (2010) lists 27 studies finding a positive OA advantage and 4 studies with no advantage or no disadvantage. Sparc Europe’s OpCit project (SPARC-Europe 2016) found a total of 70 studies on the citation advantage of which 46 found a citation advantage. More recent research (Wang et al., 2015) has shown that open access papers are not only cited more but also **downloaded** more and during a longer period and with increased social media **visibility**.

More recent research (Emery et al., 2017)(Springer Nature et al., 2020) confirms similar benefits for open access books, namely increased findability on the internet, more citations and increased readership across more countries.

“Sharing data fosters new collaborations and leads to more reliable and transparent research”.

Several papers across disciplines over the last decade consistently show a positive association between data sharing and **citations**: in disciplines as varied as cancer microarray trials (Piwowar et al., 2007), gene expression microarrays (Piwowar & Vision, 2013), astrophysics (Drachen et al., 2016; Henneken & Accomazzi, 2011), paleoceanography (Sears, 2011), and peace and conflict studies (de Mesquita et al., 2003) data sharing has been shown to be positively associated with citations. These studies typically find a citation advantage of 20% to 40%. Christensen et al. (2019) confirms these findings across disciplines by looking at data-sharing policies of 17 high impact journals.

How sharing data leads to more **collaborations** is less well studied. A compelling example related to the work of ecologist Thomas Crowther can be found in (Popkin, 2019). A case study of motivations in astrophysics (Zuiderwijk & Spiers, 2019) shows that collaboration (including new collaboration opportunities resulting from openly shared data) was one of the factors driving researchers to openly share research data. The results in this study are based on interviews with nine astrophysicists based at a single university department in the UK. However, a more recent systematic literature review to analyze factors influencing open research data adoption (Zuiderwijk et al., 2020) finds that researchers are driven to openly share their data both for possible collaboration and network opportunities. For example, openly sharing data creates ample opportunities to participate in new international projects, widening local scientists’ networks (Arza & Fressoli, 2018) and allows

networking with other scientists for various interdisciplinary studies (Enke et al., 2012). And data sharing enhances the potential for collaboration among scholars with similar research interests (Harper & Kim, 2018; Zuiderwijk & Spiers, 2019). Zuiderwijk (2020) also finds that open data reuse allows proactive collaboration across diverse groups: “when a researcher finds out that another researcher has openly shared data on a topic that is of interest to both of them, they might start collaborating on the use of the shared data”.

Many journals and research funders nowadays have data sharing policies. PlosOne is a journal with one of the strictest policies. The ambition to increase **transparency, reliability and replicability** of research outcomes is an important driver for these policies. Studies like those of Wallach (Wallach et al., 2018) show that indeed the reproducibility of biomedical research has increased as a result of open access data policies.

“Open Science leads to better science. But also to more impactful science as everyone is able to access and reuse your results. That can be other researchers and professionals like teachers and health practitioners, but also companies that want to innovate”

Implications of open access in non-academic contexts (e.g. medical practice, policymaking, patient advocacy and citizen science) are at the basis of a lot of the open access advocacy work. Indeed (Elsabry, 2017; ElSabry & Sumikura, 2020) shows that many open access policies of funding agencies are motivated by the expected social and economic benefits of open access. There has not been a lot of original research to substantiate these claims. Mostly because it is methodologically challenging to measure non-academic use of scientific literature and its impact. A recent meta-study by ElSabry (ElSabry, 2017) lists a total of 53 papers about the societal benefit of Open Access and reports on potential benefits for industry researchers, policymaker, NGO’s, patient groups, practioners like medical professionals and independent researchers.

There has been quite some research that made the case for the **economic benefits** of open access (Houghton & Sheehan, 2009). In the UK much of the advocacy for open access has been underpinned by referring to the work of the distinguished economic historian Joel Mokyr (Mokyr, 2004) who has argued that one of the reasons why Britain has seen an early industrial revolution in the 18th century was the very rich and effective infrastructure to freely communicate new ideas (Willems, 2003).

The claims that open access leads to economic benefits is closely linked to arguments that academic **research is a common good** which is publicly funded and therefore ought to be in the public domain. This “moral” case for open access has been further developed by (Bacevic & Muellerleile, 2018); (Willinsky, 2006). Organizations such as UNESCO have made the case for open access based on a social justice philosophy: the fundamental human right to access scholarly literature ((UNESCO, 2019).

BIBLIOGRAPHY

- Arza, V., & Fressoli, M. (2018). Systematizing benefits of open science practices. *Information Services and Use*, 37(4), 463–474. <https://doi.org/10.3233/ISU-170861>
- Bacevic, J., & Muellerleile, C. (2018). The moral economy of open access. *European Journal of Social Theory*, 21(2), 169–188. <https://doi.org/10.1177/1368431017717368>
- Christensen, G., Dafoe, A., Miguel, E., Moore, D. A., & Rose, A. K. (2019). A study of the impact of data sharing on article citations using journal policies as a natural experiment. *PLoS ONE*, 14(12), 1–13. <https://doi.org/10.1371/journal.pone.0225883>
- Davis, P. M. (2011). Open access, readership, citations: a randomized controlled trial of scientific journal publishing. *The FASEB Journal*, 25(7), 2129–2134. <https://doi.org/10.1096/fj.11-183988>
- de Mesquita, B. B., Gleditsch, N. P., James, P., King, G., Metelits, C., Ray, J. L., Russett, B., Strand, H., & Valeriano, B. (2003). Symposium on replication in international studies research. *International Studies Perspectives*, 4(1), 72–107. <https://doi.org/10.1111/1528-3577.04105>
- Drachen, T. M., Ellegaard, O., Larsen, A. V., & Dorch, S. B. F. (2016). Sharing data increases citations. *LIBER Quarterly*, 26(2), 67–82. <https://doi.org/10.18352/lq.10149>
- Elsabry, E. (2017). Claims about benefits of open access to society (Beyond Academia). *Expanding Perspectives on Open Science: Communities, Cultures and Diversity in Concepts and Practices - Proceedings of the 21st International Conference on Electronic Publishing*, 34–43. <https://doi.org/10.3233/978-1-61499-769-6-34>
- ElSabry, E. (2017). Who needs access to research? Exploring the societal impact of open access. *Revue Française Des Sciences de l’information et de La Communication*, 11. <https://doi.org/10.4000/rfsic.3271>

- ElSabry, E., & Sumikura, K. (2020). Does open access to academic research help small, science-based companies? *Journal of Industry-University Collaboration*, ahead-of-p(ahead-of-print). <https://doi.org/10.1108/jiuc-04-2020-0004>
- Emery, C., Lucraft, M., Morka, A., & Pyne, R. (2017). The OA effect: How does open access affect the usage of scholarly books? *Springer Nature (Online)*, 1–36. <https://www.springernature.com/gp/open-research/journals-books/books/the-oa-effect>
- Enke, N., Thessen, A., Bach, K., Bendix, J., Seeger, B., & Gemeinholzer, B. (2012). The user's view on biodiversity data sharing - Investigating facts of acceptance and requirements to realize a sustainable use of research data -. *Ecological Informatics*, 11, 25–33. <https://doi.org/10.1016/j.ecoinf.2012.03.004>
- Harper, L. M., & Kim, Y. (2018). Attitudinal, normative, and resource factors affecting psychologists' intentions to adopt an open data badge: An empirical analysis. *International Journal of Information Management*, 41(March), 23–32. <https://doi.org/10.1016/j.ijinfomgt.2018.03.001>
- Henneken, E. A., & Accomazzi, A. (2011). *Linking to Data - Effect on Citation Rates in Astronomy*. May, 1–5. <http://arxiv.org/abs/1111.3618>
- Houghton, J., & Sheehan, P. (2009). Estimating the Potential Impacts of Open Access to Research Findings. *Economic Analysis and Policy*, 39(1), 127–142. [https://doi.org/10.1016/S0313-5926\(09\)50048-3](https://doi.org/10.1016/S0313-5926(09)50048-3)
- Lawrence, S. (2001). Free online availability substantially increases a paper's impact [1]. *Nature*, 411(6837), 521. <https://doi.org/10.1038/35079151>
- Mokyr, J. (2004). *The Gifts of Athena: Historical Origins of the Knowledge Economy*. Princeton University Press.
- Piwowar, H. A., Day, R. S., & Fridsma, D. B. (2007). Sharing detailed research data is associated with increased citation rate. *PLoS ONE*, 2(3). <https://doi.org/10.1371/journal.pone.0000308>
- Piwowar, H. A., & Vision, T. J. (2013). Data reuse and the open data citation advantage. *PeerJ*, 2013(1), 1–25. <https://doi.org/10.7717/peerj.175>
- Popkin, G. (2019). Data sharing and how it can benefit your scientific career. *Nature*, 569(7756), 445–447. <https://doi.org/10.1038/d41586-019-01506-x>
- Sears, J. R. L. (2011). Data sharing effect on article citation rate in paleoceanography, Abstract IN53B-1628, presented at 2011 Fall Meeting, AGU, San Francisco, Calif., 5-9 Dec. *Nature*.
- Springer Nature, O. A. B., Pyne, R., Lucraft, M., Emery, C., Neylon, C., Montgomery, L., & Ozaygen, A. (2020). *Diversifying readership through open access: A usage analysis for OA books*. <https://doi.org/10.6084/m9.figshare.12746177>
- Swan, A. (2010). *The Open Access citation advantage. Studies and results to date*. <http://eprints.soton.ac.uk/id/eprint/268516>
- UNESCO. (2019). *Is Science a Human Right? Implementing the Principle of Participatory, Equitable, and Universally Accessible Science*. September. [https://en.ccunesco.ca/resources#:f=6763014C-F01C-4D30-874D-4436C1903592:range=\[1514775600000,1577847600000\]](https://en.ccunesco.ca/resources#:f=6763014C-F01C-4D30-874D-4436C1903592:range=[1514775600000,1577847600000])
- Wallach, J. D., Boyack, K. W., & Ioannidis, J. P. A. (2018). Reproducible research practices, transparency, and open access data in the biomedical literature, 2015–2017. *PLoS Biology*, 16(11), 2015–2017. <https://doi.org/10.1371/journal.pbio.2006930>
- Wang, X., Liu, C., Mao, W., & Fang, Z. (2015). The open access advantage considering citation, article usage and social media attention. *Scientometrics*, 103(3), 1149–1149. <https://doi.org/10.1007/s11192-015-1589-3>
- Willets, D. (2003). *Speech Open access research*. <https://www.gov.uk/government/speeches/open-access-research>
- Willinsky, J. (2006). *The access principle: The case for open access to research and scholarship*. MIT Press.
- Zuiderwijk, A., Shinde, R., & Jeng, W. (2020). What drives and inhibits researchers to share and use open research data? A systematic literature review to analyze factors influencing open research data adoption. In *PLoS ONE* (Vol. 15, Issue 9 September). <https://doi.org/10.1371/journal.pone.0239283>
- Zuiderwijk, A., & Spiers, H. (2019). Sharing and re-using open data: A case study of motivations in astrophysics. *International Journal of Information Management*, 49(June), 228–241. <https://doi.org/10.1016/j.ijinfomgt.2019.05.024>

