RI4C2
Research & Innovation
For Cities & Citizens

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Open Science Guidebook

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D7.3 – Open Science guidebook

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I. Open Science Guidebook

Open Science aims to make scientific outputs and processes open, transparent and reproducible. Convincing researchers of the benefits of Open Science practices and supporting them to develop their skills and knowledge is still needed.

Therefore, we have created an Open Science guidebook, which is a general-level and non-commercial practical online guide for researchers looking for information and tips on how to approach a range of Open Science practices. It offers guidance and resources especially for researchers but also for any other person interested in improving levels of openness in research practices. The EC2U partner universities will have the possibility to use this guidebook in their organizational support activities freely. The guide may bee published on the partner organizations' respective websites.

Overall, this guidebook supports the EC2U partner universities in developing a broader and a more practical perspective towards supporting researchers in meeting the current requirements of Open Science. It was created to be dynamic, meaning that it will be regularly updated by WP7 team when relevant during the RI4C2 project. For now, it consists of two of the most established Open Science practices, OA publishing and Open Data, and two emerging ones, Open workflows and OS communities.

The guidebook consists of the practical guidelines which are supplemented by interviews of the Open Science Champions.

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A. Open Access to research publications

OPEN ACCESS PUBLISHING

Open science has revolutionized the field of scholarly publishing and open access (OA) publishing in its various forms has already been in development for a long time. Open access publishing is a model for scholarly communication that makes research information available to readers at no cost, as opposed to the traditional subscription model in which readers have access to scholarly information by paying a subscription.

WHAT

Open access publishing makes all types of scholarly literature accessible free of charge and often carries less restrictive copyright and licensing barriers than traditionally published works, for both the users and the authors. Instead of financing their operations by collecting subscription fees, open access journals generally generate income from fees charged to the authors, also known as article processing charges (APCs). Hence, the costs of editing the journal are passed on from readers, or in practice from academic libraries that subscribe to scholarly literature, to authors. It is good to keep in mind, however, that most open-access journals are financing their operation in some other way than by APCs. Usually, the journals are published and funded by scientific associations, universities and higher education institutions or other academic organizations.

Over the years, complementary but parallel forms to OA have been advocated. Some research funders give recommendations and restrictions related to them in their funding terms. Moreover, several countries have separate national recommendations and research organizations may also have their own policy guidelines in relation to different forms of OA publishing. Currently researchers can choose from the following forms of OA publishing:

- **Green OA** publishing refers to the self-archiving of published or prepublication works for free public use. Authors provide access to preprints or post prints (with publisher's permission) in an institutional or disciplinary archive.
- **Gold OA** publishing refers to works published in an open access journal and accessed via the journal's or publisher's website. APCs are paid by the author.
- **Hybrid OA** offers authors the option of making their articles open access, for a fee. Journals that offer hybrid OA are still fundamentally subscription journals with an open access option for individual articles. They are not true open access journals.
- **Diamond OA** publishing describes journals that are completely free to publish and to read. The costs of maintaining and publishing the journal are usually borne by the organization that sponsors the journal. Diamond OA status has no impact on the journal's peer review process. By making articles completely free both to publish and to read, Diamond OA best approaches the goals of democratizing and widely distributing academic scholarship.

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The self-archiving of research publications is one cost free option that achieves openness, and most publishers allow the self-archiving of the accepted version of a manuscript. However, when an article is self-archived in the publication archive, many publishers want to place an embargo on it even if the self-archived version is the final draft of the final peer-reviewed manuscript. These embargoes vary usually from 6 to 36 months. Some publishers do not use embargoes at all. In such a case, the article can be self-archived immediately after publication.

Although OA publishing has generally been seen as beneficial, its development has increased the number of harmful, questionable and even fraudulent publishers on the market. These publishers are only in it for collecting large author fees and usually their peer review process does not fulfil the generally accepted requirements. These kinds of publishers are often called predatory publishers.

WHY

The reasons for publishing in Open Access are diverse. One of the most important advantages of open access is that it increases the visibility of academic research results. OA publishing also improves efficiency and efficacy of research and facilitates collaboration, interdisciplinary conversation and research-based innovations. Accordingly, OA publishing allows the professional, practitioner and business communities, and the interested public, to benefit from research. The wider the audience that can access and build upon the latest research, the more likely research benefits the whole society.

From a researcher's perspective, the greatest benefit of OA publishing is that it enables rapid and wide dissemination of research results. By publishing in open access, researchers can make their research results freely accessible immediately, in principle, and thus receive feedback from the academic community more quickly. Furthermore, research results presented in OA publications may become more efficiently actualized in the form of policies, treatments, funding allocations, and decisions than results published behind paywalls. Wide availability also means more readers, more potential collaborators and more citations.

HOW

For those who are interested in open access (OA) publishing, it would be useful to note the following points:

- Open access publishing covers all types of peer-reviewed publications, both journal articles and books (monographs).
- Be aware of your funder's requirements related to open access. Many funders require immediate open access and use of open licenses.
- A digital object identifier (DOI) is a unique text character sequence that is used to identify digital objects, such as journal articles. Make sure that you receive a DOI also for your preprint.
- Place your works under an open content licence, such as a Creative Commons licence, if you publish them in Open Access to make them widely reusable.

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- Through a range of tools and practical recourses you may identify trusted journals and publishers. There are various databases available to assist in choosing a reliable publication channel, e.g., Directory of Open Access Journals (DOAJ), Directory of Open Access Books (DOAB), Web of Science and Scopus.
- Use open institutional or discipline-specific archives/repositories for self-archiving and use social media and social networks to disseminate the links to your research work in open archives.

RESOURCES AND FURTHER READING:

- An open access initiative by major research funders, Plan S website:
  - https://www.coalition-s.org/why-plan-s/
- Directory of Open Access Journals (DOAJ) website:
  - https://doaj.org/
- Sherpa Romeo (database of publishers' and journals' OA policies):
  - https://v2.sherpa.ac.uk/romeo/
- Directory of Open Access Books (DOAB) website:
  - https://www.doabooks.org/
- Directory of Open Access Scholarly Resources (ROAD) website:
  - https://www.issn.org/services/online-services/road-the-directory-of-open-access-scholarly-resources/
- Tool to identify trusted journals and publishers:
  - https://thinkchecksubmit.org/
- Open Access Scholarly Publishing Association (OASPA) website:
  - https://oaspa.org/principles-of-transparency-and-best-practice-in-scholarly-publishing/
- Committee on Publication Ethics (COPE) website:
  - https://publicationethics.org
- Creative Commons website:
  - https://creativecommons.org/choose/
- Greussing et al. (2020) Drivers and Obstacles of Open Access Publishing. A Qualitative Investigation of Individual and Institutional Factors. *Frontiers in Communication*, vol. 5, pp. 1-13. Available at: https://doi.org/10.3389/fcomm.2020.587465
- Maddi, A., Lardreau, E. and Sapinho, D. (2021) 'Open access in Europe: a national and regional comparison', *Scientometrics*, 126(4), pp. 3131–3152. Available at: https://doi.org/10.1007/s11192-021-03887-1

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B. Open Data

OPEN RESEARCH DATA

Research data is the foundation of scientific knowledge and, therefore, it is also widely acknowledged to be a valuable outcome of research. It underpins the results of scientific research and enables derivation of theoretical or applied findings. The demand for open research data has grown rapidly as various funders, publishers and institutions increasingly require researchers to open their research data. Moreover, more mechanical, managerial, and technical handling of research data has increasingly become as important a part of a researchers work as methodological or analytical data processing. Therefore, there are several different issues associated with opening data, which researchers should consider during the entire research life cycle.

WHAT

At its purest, open research data refers to data that has been made freely and publicly accessible, modifiable, redistributable, and reusable for anyone and for any purpose free from technical, financial and legal barriers. However, not all research data can be made accessible and available without restrictions. Sensitivity and identifiability of the data, copyrighted content, and intentions to commercialize research results are some of the issues to consider with caution before publishing data. Therefore, data sharing is best to be guided by the now widely recognized and adopted principle of 'as open as possible and as closed as necessary'.

Proper research data management through all stages of a research project is the most important prerequisite for reusable open data. The purpose of research data management and its advance planning in a data management plan (DMP) is to ensure that the data remains accessible, reliable, securely protected, and reusable through its entire lifecycle. A DMP facilitates the consideration of all relevant aspects of data management, including the handling, organization, documentation, storage and backup, and opening of the data. An especially critical step in securing the reusability of data is sufficient documentation and description of its content and collection procedures, that is, metadata. Contextual metadata provides the necessary information to understand the data, including how it can or cannot be used. Furthermore, standardized and machine-readable metadata facilitates discoverability of the data. Poor documentation may render otherwise publicly available data useless for any further research, including one's own.

FAIR Data principles have been designed to facilitate data management planning from the perspective of the reusability of data and are now adopted as the cornerstone of data management requirements of many funders and research organizations. FAIR stands for Findable, Accessible, Interoperable and Reusable. Each item is accompanied by practical application instructions that provide guidance on how to achieve these through data management. However, it is important to distinguish FAIR data from 'Open data'. FAIR Data principles are intended to be modular in the sense that they may be followed in various combinations depending on the circumstances. If the data cannot be made publicly available,

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for instance because of its sensitivity, it can still be considered FAIR if data management is otherwise taken care of accordingly and metadata are made publicly accessible.

WHY

The core arguments for open research data are straightforward. Opening and sharing research data according to the FAIR principles supports transparency of research enabling its verification, replication, reproduction, and refinement, and advances reuse of data, which can potentially accelerate scientific progress. Open research data also benefits stakeholders outside academia and ensures greater returns from public investment in research. This way open data brings great benefits to society. Open data also reduces fraud in science and, on the other hand, increases the public's trust in science.

From a researcher's perspective, opening research data may enhance researchers' recognition and visibility in the field. Also, researchers may maximize the usefulness of the data itself and increase their own efficiency in conducting research. Properly managed research data creates a competitive edge and is an important part of a high-quality research process. When research data are open and reproducible, researchers can build on previous knowledge, achieve better and diverse conversations across research fields, make unexpected discoveries and increase opportunities for new collaborations. Managing and opening research data according to FAIR principles improve its long-term availability even for the researcher's own purposes. Consequently, it is important that research data is openly available so that it is possible to return to it with new methods or different points of view. With constantly evolving new methods, it is possible to make sure that there are no errors in the previous analysis.

HOW

For those who are interested in generating or sharing open research data, it would be useful to note the following points:

Data Management Planning

- Research data management (RDM) is a process which needs investments of time and resources and it consists of several components such as knowing and describing your data, following ethical and legal principles, and understanding the workflows related to securing, storing, sharing, archiving, opening, and publishing your data, which must be considered at different stages of the research process.
- A data management plan (DMP) is a useful tool that helps you to plan, collect and archive your data efficiently and systematically.
- When generating open research data, try to view the documentation of your data from the perspective of the further users and your future self.
- To make research replicable, reproducible or reusable research data should be as open and FAIR (findable, accessible, interoperable and reusable) as possible, while considering ethical, commercial, and privacy constraints with sensitive data or proprietary data.

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- Sometimes the data cannot be opened for example because the researcher is not the owner of the data in the first place, or the data is too sensitive to be published. Although, whatever the reason is, it is always possible to open the description of the data (metadata) because the fact that the existence of the data is known is essential from the point of Open Science.

Ethical and legal considerations

- It is good to note that 'research data' means different things to different disciplines and not all research data can be made available without restrictions.
- In research involving human participants, disclose your plans of opening the data in the participant information sheet, and obtain the participants' express consent to retain and share the data with the consent form.
- Data anonymization helps you to protect sensitive data and the anonymized data is not subject to protection regulations.

Long-term preservation and sharing

- Licenses, such as Creative Commons (CC), can be applied to any material (e.g., sound, text, image, multimedia, software) where some exploitation or usage rights exist, and it would also be important to use standardized licenses for your research data.
- The recommended way to store and to share data is to deposit it in a trustworthy online repository with permanent accessibility and storage of the research data.
- Both discipline-specific and cross-disciplinary data repositories exist. Some examples of widely used generic data repositories are e.g., Zenodo and Open Science Framework (OSF).
- When selecting a repository for your data, prefer certified repositories and ensure that the repository of your choice provides data with a persistent identifier (PID), such as digital object identifier (DOI), which facilitates searching, discovery, reuse, and citing of your research data.
- Be mindful of your institution's policies and recommendations regarding the preferred repositories and long-term preservation and sharing of your research data.

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RESOURCES AND FURTHER READING:

- European data strategy 2020:
  - https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52020DC0066&from=EN
- Open Knowledge Foundation: Open Data Handbook
  - http://opendatahandbook.org/
- Creative Commons website:
  - https://creativecommons.org/choose/
- Know Your Data – Research Data Management (RDM) (2021) Vol. 3 No. 1. https://journals.helsinki.fi/thinkopendigest/issue/view/145
- Registry of Research Data Repositories
  - https://www.re3data.org/
- Meyer, M.N. (2018) 'Practical Tips for Ethical Data Sharing', *Advances in Methods and Practices in Psychological Science*, 1(1), pp. 131–144. Available at: https://doi.org/10.1177/2515245917747656.
- Wilkinson, M.D. et al. (2016) 'The FAIR Guiding Principles for scientific data management and stewardship', *Scientific Data*, 3(1), p. 160018. Available at: https://doi.org/10.1038/sdata.2016.18.

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C. Open workflows

OPEN WORKFLOWS

Advances in information technology have created possibilities to share digital scholarly objects in ways that were not feasible before. In recent years, much of the focus of the Open Science movement has been on broadening the access to different research outputs, primarily publications and data. However, as new technical tools and internet are increasingly liberating researchers from the communication limitations of a traditional research paper, more and more attention is being given to the transparency and reusability of research workflows.

WHAT

On a general level, a workflow can be understood as an organized series of steps designed for achieving a particular result. A research workflow, then, refers to a set of actions taken, routines followed, decisions made, and tools utilized over the course of a research project. Open research workflows entail that researchers embrace and extend the Open Science principles to the entire research cycle and organize and carry out their work in a transparent, replicable and reproducible manner. Essentially, transparent and repeatable workflows require that each step of the research process is comprehensively documented and explicitly represented to facilitate verification and understandability of the results and reasoning behind them, to improve reuse utility of the used methods and data, and to enhance replicability and reproducibility of research.

Instead of a single Open Science practice, open workflows can be understood as varying collections of behaviours with the common aim of making the research process transparent at each of its steps. It is important to note, however, that open workflows do not suggest exposing research. While the eventual target in all research should be the shareability of the workflow to the public, in many cases, sharing e.g., data or materials prior to publication may be out of question. Key factors for open workflows are clear, thorough documentation of how research is conducted and access to information needed to reproduce the procedures and understand the choices made. Components of the workflow vary across disciplines and contexts, but examples include instruments, data, tools, methods, code and scripts. While open workflows are approached differently depending on the discipline and context, the general idea of keeping an organized record of the process and being able to communicate its steps meaningfully to others is applicable to any research across all disciplines.

Numerous dedicated tools now exist for workflow management. These tools allow setting up of a public or a private project page with cloud storage space for different types of project files. Their other important features include version control and time stamping of digital objects and possibility to share the project with others ability to control who has access to the content. Furthermore, online workflow repositories can be assigned their own DOI (digital object identifier) making it possible for others to cite the project.

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WHY

Open workflows are emerging as a practice that significantly enhances transparency and reproducibility of research. Open workflows are essential for enabling others to understand the context and reasonings behind decisions and choices of the researcher and on the other hand to replicate and refine the research process. Open workflows also encourage researchers to employ standard structures for e.g., data and code archiving. However, implementation of open workflows varies based on context, and depending on the discipline, greatest benefits may relate to e.g., preregistration, code, data, methods or results. Finally, open workflows may improve efficiency of research. Especially, script-based workflows are infinitely reusable and transferable to other datasets bringing significant time savings.

From a researcher's perspective, careful recordkeeping through the course of a research project helps to keep the project organised, minimises errors, provides protection against losses of valuable information, and contributes to long-term preservation of research outputs for others but also for one's own purposes. Allowing others to view and evaluate the research project while it is still ongoing allows for detecting errors, providing and incorporating feedback which can be beneficial in terms of quality of research and lead to more robust research results. Furthermore, open sharing of the workflows before publication to others in an online repository increases visibility of one's work, allows for receiving credit in the form of citations, and finally may facilitate new and unexpected collaboration.

HOW

For those who are interested in getting started with open workflows, it would be useful to note the following points:

- As you plan the steps of your work it might be useful to centralize and organize your project management using an online platform, a central repository, or folder for all research files.
- Workflow repositories, such as Open Science Framework (OSF) or GitHub, provide a structure for sharing your research openly and help you to manage, control access, archive, and share each step of your research project.
- Use of open licenses and persistent identifiers facilitates reuse by others and helps to protect one's work and receive credit for it.
- Using open-source software or proprietary software that uses open file formats facilitates accessibility to other researchers, supports interoperability and provides protection against future losses of valuable information due to the end of support for a particular custom file format.

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RESOURCES AND FURTHER READING:

- Workflow management tools:
  - Open Science Framework: https://osf.io/
  - GitHub: https://github.com/
- Tool for choosing a licence:
  - https://choosealicense.com/
- 101innovations website:
  - https://101innovations.wordpress.com/
- Hampton, S.E. et al. (2015) 'The Tao of open science for ecology', *Ecosphere*, 6(7), pp. 1-22. Available at: https://doi.org/10.1890/ES14-00402.1.
- Van Lissa, C.J. et al. (2021) 'WORCS: A workflow for open reproducible code in science', *Data Science*, 4(1), pp. 29–49. Available at: https://doi.org/10.3233/DS-210031.

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D. Open Science communities

OPEN SCIENCE COMMUNITIES

Grassroots campaigns led by pioneering scholars are perceived to have a central role in the transition to Open Science, and particularly regarding the normalization of open research practices. Bottom-up networks promoting Open Science, also known as Open Science communities, are a single increasingly visible manifestation of this type of grassroots activity. OS Communities bring together researchers from across disciplines and different career stages for the purpose of facilitating adoption and mainstreaming of OS practices. Over the last few years, a multitude of Open Science communities with diverse emphases and approaches have emerged worldwide. Despite their differing aims and scopes, the OS communities are all jointly working towards integrating open scholarship into research community by advancing research transparency, reproducibility, and integrity through research practice reform.

WHAT

In recent years, OS has become a recognized course of action in academic environments. However, the actual adoption of Open Science practices often lags behind. While some practices, such as OA publishing, have reached levels of adoption that allow them to be viewed as to have become the standard way of producing scientific knowledge, others are not close to being mainstream. One of the main barriers on the way to a wider adoption of OS practices has been recognized to be the academic culture itself. A shift towards a culture more favorable of Open Science is an interplay between multiple factors, including provision of necessary and easy-to-use infrastructure to make the OS practices feasible in the first place, normalization of OS practices, introduction of incentives for researchers to adopt OS practices, and imposition of policies to further consolidate their application.

Open Science communities are bottom-up learning and advocacy groups for researchers at different career stages and disciplines. They gather researchers together to discuss experiences and concerns about the application of diverse OS practices. In addition, they actively seek to engage in dialogue with stakeholders, such as institutions, funders and publishers, to promote more transparent research practices and find solutions to overcome obstacles hindering their widespread adoption. By breaking the boundaries of academic fields and geographical locations, OS communities contribute to making the discussion of Open Science more diverse and representative of the varied needs of academics.

While OS communities are typically characterized by their researcher-led operations model and local embeddedness in a specific institution or area, they are often closely interconnected to their counterparts in other countries forming international networks of similarly oriented communities. This provides added leverage in their efforts to institutionalize Open Science through shaping institutional OS policies and dialogue with external stakeholders. International umbrella organizations offer pre-existing networks for new communities to tap into, and on-boarding and practical support in setting up one's own institution- or city-based node.

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WHY

Being inclusive and easily approachable communities offering a low entry point into Open Science and increasing the visibility of OS practices in their local setting, OS communities have the potential to act as important drivers of the cultural shift especially in terms of normalization of Open Science practices. Overall, OS communities enable advancement of knowledge, facilitate communication and provide support for effective adoption and mainstreaming of OS practices among scholars.

OS communities may also serve as a fertile ground for the emergence of impactful OS initiatives, and multiple notable examples of such cases already exist. While holding on to their grassroots identity and relative independence from their respective institutions, many OS communities actively pursue meaningful interactions with a variety of stakeholders to advance the common cause of promoting more transparent, inclusive and reliable high-quality research.

From a researcher's perspective, OS communities provide a platform for peers to interact, get inspired and learn from one another, to acquire skills and receive guidance on OS practices that one may already be familiar with and also on practices that may not yet be applied commonly in all disciplines. Moreover, sharing experiences about OS practices may reveal that sometimes researchers from different disciplines have a lot of things in common, even more than one might have initially assumed.

HOW

For those who are interested in participating in OS community activities or establishing a local OS community, it would be useful to note the following points:

- OS communities are open especially to researchers in academia, but also to students, research managers and administrators, funders, publishers and citizens.
- OS communities focus on organizing, promoting, and facilitating events and workshops for researchers to learn about and discuss open science practices, share their expertise, and build professional networks.
- Some of the prominent examples of international umbrella organizations of OS communities are International Network of Open Science & Scholarship Communities (INOSC), Reproducibility Network (RN) and Open Knowledge Foundation (OSF).
- The activity and success of an OS community depend on the contributions of its members.
- When establishing a new local OS community, it is not necessary to reinvent the wheel because there are many existing bottom-up OS communities worldwide that have navigated through different obstacles and are willing to share their knowledge and experience.

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RESOURCES AND FURTHER READING:

- International Network of Open Science & Scholarship Communities (INOSC):
  - https://osc-international.com/
- Reproducibility Network (RN) country nodes:
  - DE: https://reproducibilitynetwork.de/
  - FI: https://www.finnish-rn.org/
  - IT: https://www.itrn.org/
  - PT: https://www.ptrn.pt/
- Open Knowledge Foundation
  - https://okfn.org/
- Berkeley Initiative for Transparency in the Social Sciences:
  - https://www.bitss.org/
- Armeni, K. et al. (2021) 'Towards wide-scale adoption of open science practices: The role of open science communities', *Science and Public Policy*, 48(5), pp. 605–611. Available at: https://doi.org/10.1093/scipol/scab039
- Nosek, B. (2019) Strategy for Culture Change. Available at: https://www.cos.io/blog/strategy-for-culture-change

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II. Interviews

A. Overview

For the purposes of this guidebook, we have conducted six interviews with Open Science Champions, researchers who routinely implement Open Science practices in their own academic work and also promote Open Science in their own respective institutions (see annexes 1-6).

The Open Science Champions were identified in the first phase of the RI4C2 project 'Case descriptions on Open Science' (D7.1) in which we collected case descriptions from researchers who have adopted Open Science practices in their research. The choice of interviewees was also guided by the willingness to obtain representation from multiple academic fields and from different partner universities of the EC2U Alliance.

The interviews were conducted and recorded online in February 2023. All interviews were transcribed by a company providing professional language services.

Insights presented by the interviewees were used in drafting the practical guidelines of this guidebook. Edited text versions of the interviews will be published on the public website of the EC2U Alliance (https://ec2u.eu/) and on the public website of the University of Turku Open Science Accelerator (https://sites.utu.fi/openutu/en/). The interviewee's name, title, short bio and picture will be published in connection with the interview.

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B. Publishing schedule

The interviews of the Open Science Champions will be published according to the following schedule:

Interviewee	University	Country	Topic	Publication date
Maria Ribeiro	University of Coimbra	Portugal	Open Data	05.04.2023
Mrudula Arankumar	University of Jena	Germany	Open workflows	12.04.2023
Nicolas Pinet	University of Poitiers	France	OA Publishing	19.04.2023
Leo Lahti	University of Turku	Finland	Open workflows	26.04.2023
Lydia Laninga-Wijnen	University of Turku	Finland	OS Community	03.05.2023
Kim Holmberg	University of Turku	Finland	Science Communication	10.05.2023

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III. Annexes

Annex 1 Interview guideline Open Data (Maria Ribeiro)

OPEN SCIENCE IN GENERAL

- Could you briefly describe your own research, and how you have applied open science to it?
- You do research in the field of human neuroscience. How do you view the value of open science in your field in general?

OPENING AND SHARING RESEARCH DATA

- You took on the effort of opening and sharing your research data for the first time a couple of years ago. Could you briefly explain the process of opening research data from the perspective of your own research?
- How do you perceive the value of opening research data on a general level? Why should researchers pursue it?
- How do you view the role of research data management and data management planning in relation to opening data?
- How do you perceive the popularity of data sharing in your field? Is it becoming a standard practice?
- Some of the often-mentioned benefits of sharing data from a researcher's perspective are increased citations, recognition and new cooperation opportunities. Have you personally experienced the practice of data sharing as beneficial for yourself, and in what ways?
- Your data has received quite a bit of interest. Did you take any specific actions to increase its visibility?
- What kinds of challenges did you encounter in the process of opening your data?
- What kinds of support on the part of the university would you deem helpful for researchers who are new to the practice of opening their data?
- Your research involves human participants. What kinds of ethical issues did you need to take into account in the process in regard to opening this type of data?
- Which tools and platforms did you utilize in the process? Could you give us some examples?
- Could you share any tips with researchers who are considering taking the effort of opening their data for the first time?

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Annex 2 Interview guideline Open workflows (Mrudula Arankumar)

OPEN SCIENCE IN GENERAL

- Could you briefly describe your own research, and how you apply open science to it?
- You do research in the field of psychology. How do you view the value of open science in your field?
- Which specific open science practices you consider the most important from the perspective of your own research?

OPEN AND REPRODUCIBLE WORKFLOWS

- You have been determined to pursue openness and transparency from the beginning of your research career, and have adopted various open science practices in your research, including open workflows. Could you shortly explain what does open workflow mean to you?
- Could you tell us more about opening your workflows? Can you give us some concrete examples from the perspective of your own research?
- How do you perceive the popularity of these practices in your field? Are they the norm?
- What do you think are the main benefits of open workflows from the perspective of a researcher?
- What are some of the challenges that you have encountered on your journey in making your research transparent through opening your workflows?
- What tools or platforms have you found useful in opening your workflows? Could you give us some examples?
- You rely heavily on open-source software in your own research. What is the significance of open-source software in making research transparent and analyses reproducible?
- There appears to be an active online community that is involved in the development of these tools, and also provides support for others in the community. How have you engaged these communities, and how do you view the benefits of participation?
- Could you share some tips for researchers who are considering opening their workflows? How do you get started?

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Annex 3 Interview guideline OA Publishing (Nicolas Pinet)

ORGANIZATIONAL POLICIES

- Does your organization have a policy / policy for open science? What areas/elements (e.g., OA to publishing, RDM, etc.) are covered in it? Do you have an independent principle on Open Access publishing?
- Has your organization defined a specific goal for open access to research publications and a timeline for achieving this goal? How is your institution dealing with monitoring of open access to publications?
- What type of infrastructure does your organisation provide in relation to open access to publications? (Organizational repository/Publishing platform)
- Is your organization preparing for the implementation of Plan S? Could you specify your organizations' future plans regarding Plan S?

OA PUBLISHING

- How do you view the level of researchers' awareness in regard to Open Access publishing?
- Does the organization encourage researchers to deposit preprints in e.g., organizational repositories? Have you identified some good practices in relation to this?
- How common is it to deposit preprints?
- How does the organization support researchers in regard to the costs of Open Access publishing? How is your organization engaged in the national agreements?
- In what ways have you supported and increased researchers' awareness of predator journals?
- In what ways have you supported and increased researchers' awareness of ORCID profile?
- In your opinion, what are the main barriers/challenges for researchers to publish Open Access?
- What kinds of national initiatives are ongoing to promote Open Access publishing e.g. in relation to OA publication channels?

SUPPORT & TRAINING

- What kind of support services does your organisation provide to researchers to make their research publications available in open access?
- Does the organisation provide training to researchers in relation to OA publishing? What kinds of training are provided? For whom is the training targeted?

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Annex 4 Interview guideline Open workflows (Leo Lahti)

BACKGROUND

- You are associate professor in data science. Please tell us more about your own research? What does a data scientist do?

OPEN SCIENCE AND WORKFLOWS

- You have been active in promoting Open Science for a very long time. How do you view the current state of Open Science, and how do you perceive openness in research in general?
- Why should one pursue open practices in research?
- You have committed to pursue open research practices through the entire research process. What does the openness of research process mean to you, and what kinds of practices are associated with it?
- In your research, one of the central concepts and OS practices is open workflows. What is a workflow, and what does it mean to open it? How do open data, code and methods relate to open workflows?
- In data science and in computational sciences, open workflows are supported by technical infrastructure and active communities of developers formed around different platforms and tools. Please tell us how do you approach open workflows in your own research?
- In your view, what are the greatest benefits of open workflows for an individual researcher? And how about from a wider perspective?
- What kinds of challenges have you encountered related to opening your workflows in your own research?
- Would you like to share any tips for early career researchers? How to approach open workflows?

FUTURE PROSPECTS

- What kind of development steps would you like to see in terms of open research practices in the near future?
- From your point of view, what kinds of obstacles do we still need to overcome in the transition to more open research practices?
- What kind of support would you wish from research organizations in facilitating open science practices?

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Annex 5 Interview guideline Open Science Communities (Lydia Laninga-Wijnen)

OPEN SCIENCE IN GENERAL

- You do research in the field of psychology. Please tell us more about your research?
- You are an active promoter of Open Science. How did you learn about Open Science in the first place?
- How do you view the value of Open Science in general?
- Which Open Science practices have you adopted in your own research?

OPEN SCIENCE COMMUNITY BUILDING

- The specific topic we would like to discuss with you today is Open Science Communities. What is an Open Science Community?
- What are the Open Science Communities aiming for? Why do they exist?
- What is the target audience of OSCs? Who participates in their activities?
- How do you perceive the role of Open Science Communities in the transition to Open Science?
- You have been involved in the activities and in the establishment of multiple OSCs in the Netherlands and in Finland. Please tell us more about your history with OSCs?
- How did you get involved in these communities in the first place?
- Could you give some concrete examples of successful activities by OSCs?
- How do you view the benefits of participation for an individual researcher?
- How do you initiate an Open Science Community? What steps need to be taken?
- The adoption and also the relevance of specific Open Science practices vary across disciplines. Then again, the OSCs are interdisciplinary. How disciplinary differences manifest themselves in the activities of OSCs?
- What is your view on how universities should support the establishment and operation of OSCs?
- Could you share tips or recommendations for researchers on how to get started? What should the researcher consider before initiating an open science community?

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Annex 6 Interview guideline Science Communication (Kim Holmberg)

OPEN SCIENCE

- You have been actively involved in projects that advance open science both nationally and internationally, could you tell us a little about your background, also in relation to open science?
- Your own research concerns scholarly communication in digital environments and especially in social media. In your view, how is science communication related to open science?

SCHOLARLY COMMUNICATION

- How do you find the importance of science communication targeted at wider audiences?
- How have demands for Open Science impacted science communication?
- How should science communication be in the future then? What is the direction towards which it's headed?
- Could you describe the role social media has today in science communication?
- Which factors impact the attention and coverage research gets in social media?
- Is it possible to achieve scientific as well as societal impact through social media coverage on research?
- Which tools and platforms do you think would be good for researchers to advance the visibility of their research?

ALTMETRICS

- You have done a lot of research on applying altmetrics in research evaluation as well as a metric of visibility. Could you tell us what altmetrics is?
- Is there something that researchers could do themselves to advance their altmetric visibility or success?
- Is utilizing altmetrics common in research evaluation these days or is it becoming more common? What significance could altmetrics have in future research evaluation?
- What can altmetrics tell us about the scientific or societal impact of research?
- What kinds of challenges are related to the use of altmetrics?

ORGANIZATIONAL SUPPORT

- What kind of support do you think researchers would need with science communication?
- Do you have any concrete tips as to how researchers could communicate their research in general?

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