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Open Science practices: Case synthesis

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D7.2 – Case synthesis

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II. Introduction

In this report, we present the main findings from our exploration into Open Science practices currently being implemented at European universities. To identify and discuss established and emerging Open Science practices, case descriptions about carried out practices were gathered from researchers and members of the administrative staff at the seven member universities of European Campus of City-Universities Alliance (EC2U):

- University of Coimbra (Portugal)
- Alexandru Ioan Cuza University of Iasi (Romania)
- Friedrich Schiller University Jena (Germany)
- University of Pavia (Italy)
- University of Poitiers (France)
- University of Salamanca (Spain)
- University of Turku (Finland)

Over the past 20 years, the relationship between science and society has changed and developed into a much more open and interactive direction. This development has also influenced the emergence of the principles and practices of Open Science that define how researchers should open up their methods, results and applications of scientific discoveries to the society as a whole.

Today, the development of Open Science is guided by the European Commission (Directorate-General for Research and Innovation (European Commission), 2016), United Nations (UNESCO, 2021) and national and institutional policies on Open Science. Furthermore, the advancement of Open Science is monitored at multiple levels – national, regional, and international. Systematic monitoring at the European level is carried out by the European University Association (EUA) (Morais et al., 2021).

Currently, universities are creating conditions for implementing Open Science by remodeling research and innovation practices and processes as well as challenging their existing cultures, missions and policies. Many of the European universities are developing internal Open Science policies that are aligned with national and European policies. According to the EUA Open Science Survey half of Europe's universities have Open Science policies in place, and a bit over half (59%) of the surveyed institutions rate Open Science's strategic importance as very high or high (Morais et al., 2021). In general, the goal of these policies is to increase the quality and efficiency of research and its benefits to society.

Overall, with this review of current Open Science practices we aim to support the EC2U partner universities in developing a broader and a more practical perspective towards supporting researchers in meeting the current requirements of Open Science.

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III. Open Science: From idea to practice

Open Science is an umbrella term used to refer to a current international movement promoting a transition to a more open and transparent operation model in science and research (Crüwell et al., 2019). Open Science movement aims to support researchers in more responsible research and impactful knowledge creation by fostering sharing and collaboration as early as possible and whenever it is possible. The objectives of the Open Science movement include, but are not limited to, an open access to research results and other scientific outputs, transparent workflows in research, collaborative knowledge creation, involvement of different sectors of society in the creation of scientific knowledge, reconfiguring the academic assessment and reward system to incentivize open practices in research, and establishing technical infrastructure to enable the emerging research practices (Fecher and Friesike, 2014). The ambitions of the Open Science movement encompass the whole research cycle from the processes of the creation of scientific knowledge to its dissemination and evaluation (Kathawalla et al., 2021).

The emergence of the current Open Science movement can be traced back to the 1990s when the technological development started to accelerate digitalization (Rentier, 2019). Enabled by this technological development, openness, transparency, reproducibility – which can be viewed as intrinsic ideals of the scientific knowledge creation itself – became key guiding principles in international and national level science policies (Chubin, 1985; Crüwell et al., 2019; Nosek et al., 2015).

Since 2015, significant steps have been taken at the European level to adopt Open Science as the way science and research is done in Europe. Most of the European universities share the understanding that, by embracing Open Science, it is possible to introduce new ways in which research, education and innovations are undertaken, archived and curated, and disseminated across the globe. In addition, Open Science is seen to enhance accessibility, efficiency, productivity, transparency, credibility and interdisciplinarity in research (Miedema, 2022; Spellman et al., 2017). Overall, Open Science today aims for "transparent and accessible knowledge that is shared and developed through collaborative networks" (Vicente-Saez and Martinez-Fuentes, 2018).

Now in the last few years, around the world the Open Science movement is gaining momentum and there are encouraging initiatives and interventions ongoing. Several European universities have started to pay special attention to the development of Open Science on a more practical level. This have influenced that open science has started to be approached more and more often as an array of different research practices with the common aim of making scientific work accessible and transparent for the others in the community (Banks et al., 2019; Corker, 2018; Crüwell et al., 2019; Spellman et al., 2017; Syed, 2019).

During the last few years, open access publishing has been the most widely recognized and applied Open Science practice that is applied worldwide to realizing the objectives of Open Science movement. However, in recent years in addition to open access publishing many other

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research practices have been identified to enhance the ambitions of Open Science movement. Therefore, the landscape of Open Science practices have changed and the spectrum of practices has expanded and today mainly used practices are ranging from offering an unimpeded access to the outputs of research, making research materials freely available, developing tools and infrastructure for the advancement of more open knowledge dissemination and collaborative knowledge creation, involving societal actors and citizens in the making of science, teaching open science, to participating in the policymaking (Banks et al., 2019; Crüwell et al., 2019; Rentier, 2019; UNESCO, 2021).

IV. Stories of Open Science practices

This report brings together case descriptions provided by academic researchers and expert members of university research administration about Open Science practices they have implemented or closely worked with.

Case descriptions were collected from the EC2U Alliance member universities by online data collection form on the open-source survey platform REDCap (Annex 2). Initially, the data collection form was designed to be open from 3 February until 28 February 2022. However, we extended the data collection period until 11 March 2022 as this was requested by some participants who were willing to contribute but did not have time to do so over the initial period.

The participants were recruited by sharing the questionnaire invitation through various channels, including the participating universities' respective intranets and e-mailing lists. The universities were also encouraged to directly invite researchers known to have adopted Open Science practices in their academic work. The targeted primary audience for the data collection were specifically academic researchers. However, also expert members of the research administration were welcomed to provide case descriptions about Open Science practices they had worked on.

The data collection form was divided into three parts. The first part included the necessary information to obtain the participants' informed consents, including the participant information sheet (Annex 1) and the data protection statement (Annex 3). The second part included some background questions, including participant's position, organization and field of science. Additionally, the participants who, in the first part, had given their consent to being contacted for a possible follow-up interview were requested to provide their contact details. The third part included a single context providing question mapping the participants' previous experience with Open Science practices along with the instructions and the open text fields for writing the case description.

The case descriptions were structured in the format of what, why, and how, with each sub-question having their own respective text field and instructions with supporting questions on the data collection form. First, the participants were asked to choose an Open Science practice that they had implemented and wished to provide a case description about ("what"). With the supporting questions the participants were directed to consider the context of the implementation

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and describe their previous experience with the chosen practice. Second, the participants were requested to describe their motivation to engage in the practice in the first place as well as their expectations regarding its outcomes ("why"). Finally, the participants were asked to elaborate the process of the implementation, and lay out the followed policies and guidelines, utilized support services and infrastructures ("how"). Additionally, the participants were requested to discuss the challenges they had encountered and also to provide ideas for the improvement of the process. By structuring the case descriptions in this format, we wanted to enable some comparison between the cases. After all, our aim was not to make any generalizations but to identify and systematically describe cases in which Open Science had been successfully implemented at grass-roots level.

By the end of the data collection period, a total of 48 case descriptions were collected. At least one case description was received from each of the participating institutions.

Figure 1. Participants by profession (N = 48)

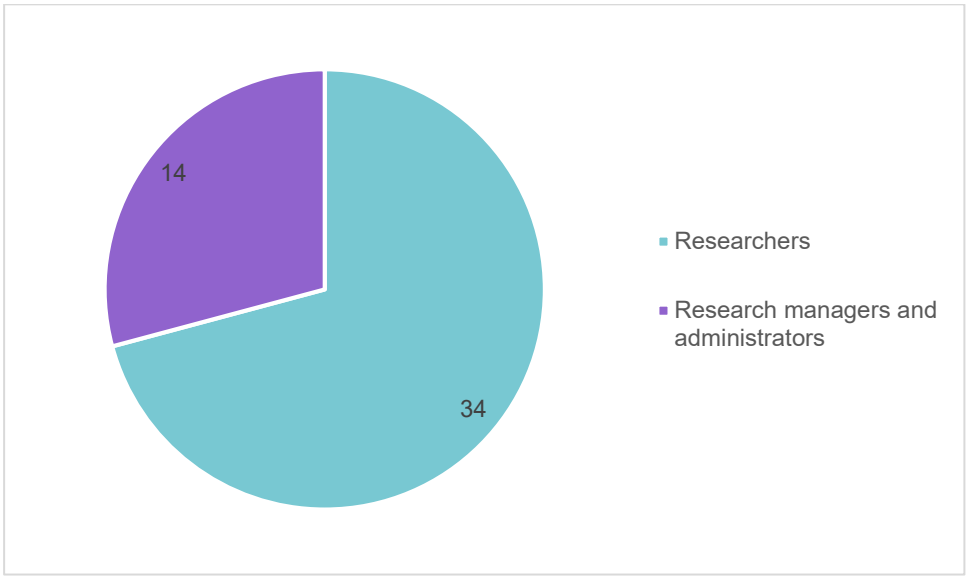

Figure 1 presents the positions held by the participants. Out of the 48 total responses, 34 were submitted by academic researchers. 14 responses were submitted by persons working in expert positions in research management and administration (e.g., university librarians, research administrators).

The researcher participants were also asked to report their field of science as the adoption and also the relevance of different Open Science practices is known to vary significantly across academic disciplines. Publishing open access in scientific journals is most popular in medical research and biology, while sharing preprints is common in physics and mathematics (Maddi et

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al., 2021). Opening research data is less customary in certain fields, such as social sciences and humanities, and issues relating to data sharing are further complicated by factors such as legislation and ethics which affect disciplines differently (Lämmerhirt, 2016). Lately, the need for the promotion of preregistration of research has been discussed especially in psychology (e.g., Crüwell et al., 2019; Kathawalla et al., 2021; Nosek et al., 2015). Citizen science has been presumed to have the most relevance in disciplines such as biodiversity and ecology (Catlin-Groves, 2012).

Figure 2. Researcher participants by field of science (N = 34)

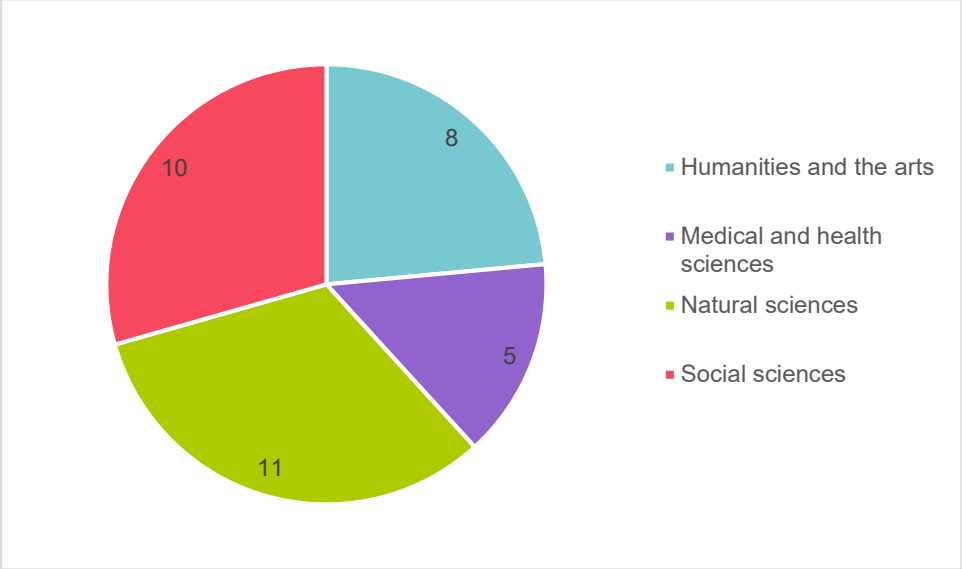

Table 1. Researcher participants by discipline

Discipline	Respondents	Discipline	Respondents
Archaeology	1	Human neuroscience	1
Biochemistry	1	Humanities	2
Biology	2	Information science	2
Biomedicine	1	Linguistics	1
Business	1	Neuroendocrinology	1
Chemistry	2	Pharmacology	1
Computer science	2	Philology	1
Economics	3	Philosophy	1
Gender equality	1	Physiotherapy	1
Geography	1	Psychology	3
Geoinformatics	1	Social science	1
History	2	Social studies	1

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Figure 2 presents the fields of science of the researcher participants (34). The classification used in the figure is based on OECDs Fields of Research and Development classification (FORD) used for statistical and policymaking purposes by e.g., OECD, United Nations and European Union (OECD, 2015). Table 1 presents the researcher participants by discipline as reported by the participants.

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V. Main findings

A. What: An overview of the Open Science practices in case descriptions

For the purpose of writing the case descriptions, we presented the participants a preset list of recognized Open Science practices to choose from. The list of was compiled out of multiple sources including UNESCO Recommendation on Open Science (UNESCO, 2021), EUA Open Science Survey 2020–2021 (Morais et al., 2021), and a recent systematic literature review on Open Science by Vicente-Saez and Martinez-Fuentes (2018). The used list of practices cannot be viewed as comprehensive as the discussion is ongoing and new practices promoting transparency and accessibility in research keep being identified under the umbrella of Open Science. However, the most widely recognized practices were included as well as some of the emerging ones. In retrospect, it could be argued, however, that an even more compact list could have produced a more focused set of cases which might have been better in terms of comparative analysis.

Table 2. List of Open Science practices presented on the data collection form

Citizen science	Open notebooks
Collaborative bibliographies	Open research infrastructures
Crowdsourcing	Open research methods and protocols
Data sharing	Open science communities
FAIR data management	Open science education
Journal club	Open science infrastructures
Open access publishing	Open science policymaking
Open access research instruments/equipment	Open science working groups
Open code	Open-source software
Open educational resources	Participatory science
Open evaluation and peer review	Preprints
Open hardware	Preregistration
Open innovation	Science outreach and communication
Open lab books	

To provide some context for analyzing the case descriptions we first asked the participants to report the Open Science practices they had engaged in over the period of three preceding three years. This information was collected by closed multiple response question with the choices presented in the table 2. Additionally, the participants had the option to choose 'other' and specify their choice in a free text field.

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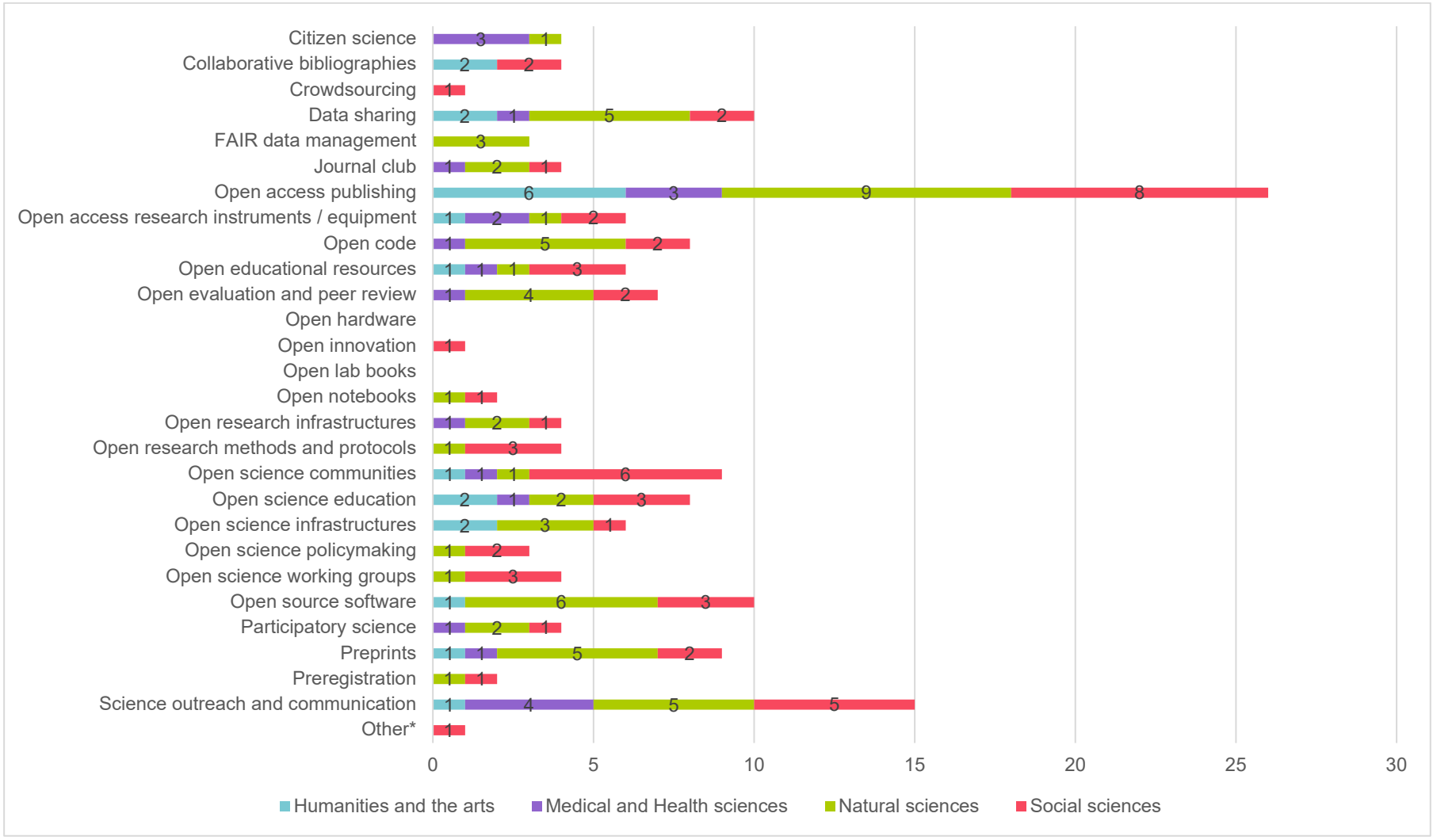
Figure 3. Open Science practices engaged in over the past 3 years by researcher participants' field of science (N = 34)



* Attending Open Science workshops and webinars

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Figure 3 presents the Open Science practices implemented by the participants over the period of three preceding years. Obviously, a small convenience sample of 34 researchers is not representative and does not allow us to make any far-reaching, let alone generalizable, claims about the prevalence of the practices. Furthermore, the researchers who took the trouble of writing a case description about an Open Science practice they had implemented are likely position themselves rather positively towards Open Science to start with. This presumed stance of the researcher participants is also suggested by the fact that most of the researcher participants reported to have adopted multiple different Open Science practices over the period of three preceding years (Table 3).

Table 3. Number of different OS practices implemented by researcher participants over the past 3 years

Number of implemented OS practices	Participants
20	1
10	3
9	1
8	2
7	1
6	4
5	1
4	4
3	7
2	3
1	7
Grand Total	34

The reported Open Science activities may indeed reflect more the particularities of our sample than anything else. Regardless of the likely skews in the sample, however, by looking at some of the figures against the results of recent quantitative studies on Open Science practices we can notice some hints of certain known trends.

Open access publishing was the most commonly adopted Open Science practice among the participants with 26 researchers out of 34 having published open access over the past three years, and 27 if preprints are also counted in. In our sample, OA publishing was also fairly evenly across different fields of science. These findings are in line with the results of the recent EUA Open Science survey according to which European universities consider open access to research publications to be the most important and implemented of the Open Science practices (Morais et al., 2021). The figures are also reflected in the adoption rate of institutional open access policies. According to the EUA Open Access survey 2017–2018 around 60% of the surveyed European research institutions had an open access policy in place at the time, and another 20% were in the midst of developing one (Morais and Borrell-Damián, 2019). Furthermore, with the adoption of Plan S by the European Commission and national research funding organizations, immediate open access publishing of research results is now widely a mandatory element in research funded by public or private grants.

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Another resemblance to the previously mentioned European survey on open science practices is the relatively high share of researchers who reported to have disseminated information about their research to the wider public, that is science outreach and communication. In EUA Open Science survey, science outreach was viewed by the European universities with the second highest level of importance and implementation right after open access to research publications (Morais et al., 2021). Technological advances have introduced new ways to communicate research quickly and with relative simplicity. Online tools, such as scientific blogs and Twitter, are now widely used by researchers. However, the importance of communicating research results widely and in an understandable manner has also been stressed on the grounds of securing political support and funding for research in a social environment characterized by an increasingly critical lay public (Puschmann, 2014).

Open data and thought-through management of research data make another highly visible topic in the discussion on Open Science. In our sample, however, seven researcher participants reported to have engaged in data sharing, and only three of them reported to have adopted FAIR principles in data management, that is making research data findable, accessible, interoperable, and reusable. These figures could be viewed as rather low taking into account the recognized significance of the topic and also the presumption that the participants are likely to represent a relatively positive stance towards Open Science. As shown by the EUA Open Science survey, however, the implementation of data-related areas of Open Science lags behind their perceived importance at the institutional level (Morais et al., 2021). Still, as European Commission and national funding organizations are increasingly requiring FAIR-compliant data management plans from their funded research projects, institutional efforts to develop this area may be accelerating in the near future.

Moving on to the case descriptions, as reported by the participants, the collected descriptions covered open access publishing, science outreach and communication, open educational resources, data sharing, open code, science outreach and communication, open science infrastructures, open access research instruments, open source software, FAIR data management, open code, collaborative bibliographies, data sharing, open notebooks, open research infrastructures, open science communities, open science education, open science policymaking and preprints.

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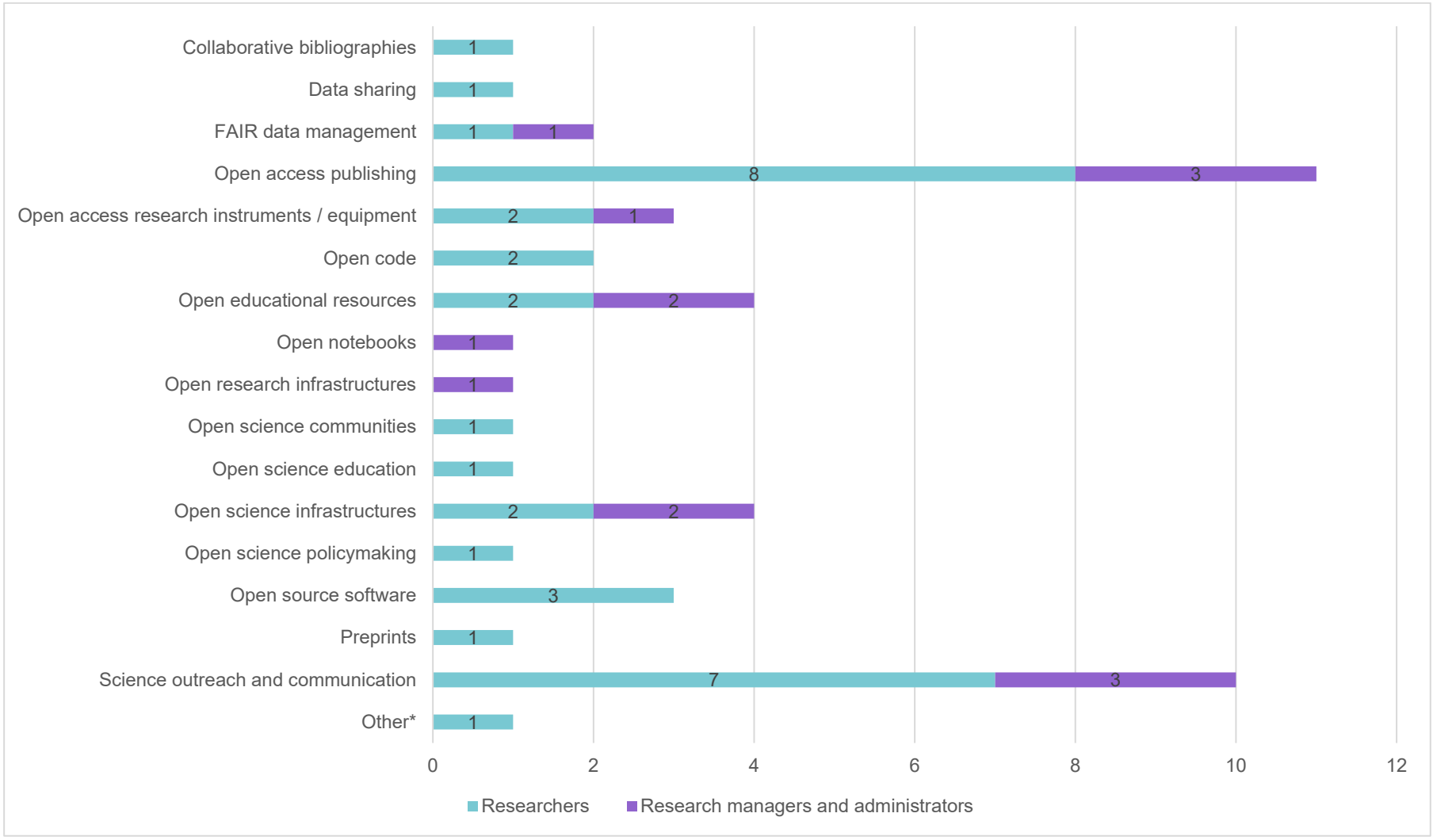
Figure 4. Case descriptions by Open Science practice and participant's profession (N = 48)



* Teaching Open Science

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Accessibility, a core principle in Open Science (Directorate-General for Research and Innovation (European Commission), 2016; UNESCO, 2021), was a central theme in our sample of case descriptions. Access to research outputs was present in descriptions related to *research results, data, educational resources, software, code, and infrastructures*. The single most popular topic in our sample was open access publishing. This is in line with the recent development of Open Science, as OA publishing is now one of the most established Open Science practices, and the share of open access publications has increased significantly all over Europe over the past 20 years (Maddi et al., 2021). Institutional and national OA policies are now commonplace (Morais et al., 2021), and major funders are requiring immediate open access to research publications (see Plan S). The reasons presented by the respondents for promoting accessibility of scientific outputs included democratic proliferation of knowledge, scientific impact, reproducibility, transparency, and public trust. Moreover, the respondents referred also to top-down requirements from e.g. funders and their research organizations. Main challenges brought forward were related to shortage of resources including funding, time and training.

Another central theme in the case descriptions was the communication of research to wider audiences and the involvement of different sectors (e.g. citizens, business organizations) of society in the creation of scientific knowledge. This theme was present in several descriptions related to *science outreach and communication and the development of the infrastructures that enable interaction with different actors*. Expectedly, this theme was included in case descriptions as getting research results across to society has always been integral to researchers in order to allow practical applications and use of scientific knowledge for example in decision making (Puschmann, 2014). The reasons presented by the respondents for engaging in science outreach included promoting the democratic value of making knowledge available to everyone and enabling wide application and recognition of scientific knowledge by the wider public. Main challenges highlighted were related to reaching target audiences inclusively and translation of the complex scientific issues in understandable language.

The third prominent theme in our sample was the collaborative undertaking of research. In the literature, the heightened demand for collaboration in research has been explained by the increased complexity of the research process, the need to assume interdisciplinary approach in solving complex global problems, and also the possibility to increase efficiency in research through collaboration. Undoubtedly, another important factor is the recent technological development which has enabled new ways of collaboration between scholars, academic communities and various stakeholders in the first place (Fecher and Friesike, 2014). In our sample, the collaborative mode of doing research was most evident in the case descriptions concerning activities related to *the development software and code*, in which active communities of developers engage in a communal effort to create new solutions and peer-review each other's work. The reasons given for undertaking a more communal approach to research included pragmatic benefits of making the research process more efficient, increasing the quality of research work and deepening one's own know-how through close and constant communication with other experts in the same field.

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Finally, the last theme we discuss here is infrastructure. Digitalization and technological development have contributed to introduction of new technical tools applied in research. These tools are understood to be one of the driving factors behind the emergence of the Open Science movement in the first place, and are also essential for the implementation of its objectives. It is illustrative that, in one way or another, infrastructures were present in almost all of the case descriptions. Accessible research outputs require online repositories for sharing publications and data. Social media, scientific blogs and are used to engage wider public in research. Also, there were few examples more novel approaches, such as an interactive game platform. For collaborative endeavors specialized platforms and communication channels are essential. The practical challenges in development and adoption of Open Science enabling infrastructure were associated with lack of funding, training and support.

B. Why: Motivations and rationales for adopting Open Science practices

The case descriptions were rich in terms of describing the rationales and motivations behind pursuing Open Science. The researchers who made the effort to write the case descriptions are themselves at the forefront of efforts to promote Open Science. In the case descriptions the respondents brought out several motivations, ranging from the core values of academic community (e.g. openness, supporting the fellow researchers, collaboration) to necessity based on one's own needs and personal interests (e.g. visibility, citations, efficiency).

Especially those respondents who, in their own words, were mainly motivated by the core values of academic community also brought up in their descriptions that their actions were influenced by their peer researchers and the academic community that they were engaging with. These respondents described willingness to advance the creation of knowledge in their own discipline but also in society at large. The respondents often expressed these motivations explicitly:

> *"I hope to help advance science."*
>
> *"---important role in the overall dissemination and impact---"*
>
> *"---translation of scientific knowledge to the society at large."*

Although most of the respondents highlighted rather altruistic motives to engage to Open Science practices their descriptions included also more self-centered motives like wide visibility and increase in citations. Only few respondents emphasized that their commitment to Open Science practices is driven by multiple personal interests:

> *" --- able to have greater effects in terms of more reads, more citations, and more recommendations and, thus, it offers the possibility of increasing the research interest in regard to other works of the same author."*

Moreover, some of the respondents highlighted that they implement certain practices in order to respond to requirements of funding agencies or publisher. In the case descriptions it was also to some extent, either directly or indirectly, brought up that universities' Open Science policies,

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traditions of the discipline, the open learning culture of the research team, and community spirit in developer communities promote the adoption of Open Science practices:

> *"The foundation for science and technology that funds my research requires publication in open repositories."*
>
> *"It was a demand from the Journals and I consented to."*
>
> *"-- to follow my unit's objectives towards open science practices."*

Interestingly, there was an apparent discrepancy between the motives brought forward in the descriptions about open access publishing and the descriptions about other Open Science practices. While altruistic values, such as the advancement of science and democratic proliferation of knowledge, were present in each of the activity categories, reasons given for undertaking OA publishing also widely, and in some cases exclusively, included more self-interested reasonings. Increased citation was the most widely referred motive, and also the quick peer-review process of APC-collecting OA journals was mentioned. This finding could reflect the established status of open access amongst the different Open Science practices. Indeed, publishing openly might have become such a commonplace activity that it is assumed not only by Open Science advocates but also the wider crowds of researchers. This interpretation is supported by the observation that all respondents (7) who reported to have engaged in only one Open Science practice over the past three years wrote their case descriptions about OA publishing. This finding underlines the importance of taking into account the assessment and reward systems when attempting to advance the adoption of Open Science practices among researchers.

C. How: The practical implementation of Open Science practices

In the case descriptions the implementation of Open Science practices was seen as relatively easy and straightforward. Here, however, it is good to keep in mind that the case descriptions were given by those for whom the implementation of practices is probably commonplace.

In general, the respondents had a positive attitude towards the implementation of Open Science practices and adaptation of Open Science practices was seen to provide benefits for individual researchers, the scientific community and society at large. The current progresses of Open Science have increased the need for developing the research environments, infrastructures and processes. For example, several Open Science practices are linked to the use of web-based technologies, social media, websites and other digital platforms, which are becoming regular tools for example data collection, sharing, analysis, and collaboration. The use of these new technologies and platforms have also made the boundaries between researchers and their environment (e.g. academic community and other audiences like decision makers, organisations and citizens).

It is also remarkable that there are already a considerable number of digital platforms, repositories, portals and tools (e.g. GitHub, Zotero and Zenodo, mentioned in the case

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descriptions) which are actively used by researchers and research groups and new ones are constantly being developed. However, based on the received case descriptions, the use of these existing Open Science infrastructures seems to depend a lot on the scientific discipline of the researcher. For example, sharing data is not new to some scientific disciplines as opening data is considered to be an essential part of conducting research and the researchers have been doing so for many years, whilst in other disciplines researchers may have published such outputs only occasionally along with their publications. However, there are now many infrastructures providing storage for and access to research data and a growing number of researchers from different disciplines are utilizing them.

One significant support structure that advances the implementation of Open Science practices is active communities (in our case especially around open source software) in which major applications originate from individual or small groups of scholars. These bottom-up networks provide a learning environment where researchers can gain the skills to conduct open, transparent, and reliable research, and are able to discuss about the practical implementation of the Open Science practices among their peers. In our case descriptions, some respondents also emphasized the importance of the local grassroot networks and communities, which contributes to changing the norm of how research is conducted in the specific research context. However, to benefit from these networks researchers need to be open-minded, willing and able to share their ideas unreservedly without fear of embarrassment or intellectual theft.

Nonetheless, support by universities is very much needed for these bottom-up initiatives to become permanent. Yet, for universities, investing in infrastructures and services that promote Open Science can be seen as both a challenge and a significant opportunity. Many universities are already developing digital infrastructures that enable open, ethical, legal and secure access to scientific knowledge. More challenging in the near future is opening physical infrastructures for research, teaching and innovation to everyone. In the development of infrastructures, it would be important for universities to identify their strategies by which successful implementation of Open Science practices can be achieved. However, the widespread adoption of Open Science practices requires especially a culture change that leads to normalization of Open Science practices among all members of the scientific community.

VI. Concluding remarks

Our aim was to find out what Open Science practices are currently being implemented at the EC2U partner universities. To reach our aim, we collected case descriptions from researchers and specialists in university administration who have adopted and engaged in Open Science practices in their academic and professional work. Based on the received and analyzed case descriptions, we are able to make the following observations.

First, the received case descriptions focus especially on well-established practices like open access to publications, FAIR data management and science outreach. However, many of the

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European universities also support and promote more novel practices and also emerging practices of which we did not receive descriptions. During the last few years, EC2U partner universities and also other European universities are already supporting their researchers and specialist in university administration for example in the implementation of open and responsible research assessment, preregistration, copyright and creative commons licenses as well as participatory and citizen science.

Especially these more novel and emerging Open Science practices are ways that will influence and shape organizing researchers and administrations work through new digital platforms, tools, and services in the near future. Together with more established practices, such as open access publications or FAIR data management, these emerging practices contribute to make science increasingly accessible for citizens, knowledge freely available for everyone, scientific outputs available, and the process of knowledge creation more efficient and goal oriented (Banks et al., 2019; Tacke, 2011; UNESCO, 2021).

However, for these emerging practices to be adopted and become established Open Science practices they must also become an integral part of academic assessments. Currently the lack of direct Open Science reward incentives is keeping researchers from adopting wide range of Open Science practices in European universities. According to the EUA Open Science Survey, Open Science practices are considered of low importance for most universities when it comes to evaluating researchers (EUA survey 2019). This is also shown, for example, the current tenure track system that is adopted increasingly by universities around the world and which puts a strong emphasis on publications in top journals, the number of publications, and the number of citations, but places only little or no emphasis on the openness in the sharing and production of other kind of science outputs. In the near future, European universities should revise and update their current research assessment systems to reward researchers' outputs and processes such as open data sets produced, transdisciplinary of the methods used, science media content produced, community management in social networks, or engagement with a broad range of research participants. These activities and outputs exceed what is currently promoted, recognized, and rewarded through the existing career system and reward incentives articulated with universities' open science policies.

However, the work towards a more responsible assessment that better takes into account the diverse Open Science practices has already begun as Science Europe and European University Association together with European Commission have published The Agreement on Reforming Research Assessment and are launching the Coalition on Advancing Research Assessment (CoARA). The Agreement on Reforming Research Assessment seems promising as it sets a shared direction for changes in assessment practices for research, researchers and research performing organizations, with the overarching goal to maximize the quality and impact of research.

Second, Open science strategies and policies are a means to support better quality science, increased collaboration, and engagement between research and society that can lead to higher social and economic impacts of public research. However, now universities need to focus on

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developing strategies to implement Open Science practices into everyday activities. This requires recourses and development of Open Science infrastructures. It would be efficient for European universities to focus on supporting the use of Open Science infrastructures (e.g. platforms, repositories and tools) that already is existing and are being used by the researchers. However, there are challenges that lie ahead as these infrastructures are mostly adopted only by those researchers who have deeply understood the principal ideas of the Open Science movement from the perspective of their own field of science.

Also, in many cases the events related to Open Science (e.g. workshops, conferences, symposia, and discussion groups) often attract same persons who are early adopters of Open Science. While these scholars are central to the initial creation and adoption of open workflows and Open Science practices, a critical mass is needed for wide-scale adoption.

Third, there seem to remain much work to be done in order for open research practices to become the "new normal". Especially it would be important to promote wider understanding and training of open science practices in a grass-roots level. Based on the case descriptions and relatively our analysis the benefits of Open Science practices are fairly well known. In general, Open Science is understood as the creation and dissemination of new knowledge that is based on the principle of openness and transparency in the whole research cycle, fostering sharing and collaboration as early as possible. Moreover, it seems that researchers and specialists in university administration have an understanding that open and transparent research practices support core academic values, such as research integrity, cooperation, knowledge sharing and wide impact. Some researchers also have confidence that Open Science practices can work as a key to break down the boundaries between disciplines, increasing public trust in science and as a means to spark interest and foster the public's participation in research activities.

The ongoing development of the UNESCO Recommendation on Open Science is an essential step for raising awareness and inspiring new and comprehensive regional and national policies for enhancing open science globally. The active involvement of institutional leaders, in addition to national and European guidelines and regulatory frameworks, is also instrumental to creating a favorable context for the transition to Open Science. The normative structure of Open Science could be articulated through the future development of the European Research Area (ERA). The future ERA could take advantage of the European University Alliances and use them as a platform for implementing the new expansive Open Science practices and norms in European universities, and for redesigning efficient national research and innovation systems in line with the new expansive institutional goal of Open Science. This would also support the local development of Open Science practices in European universities and help them to create incentives and opportunities for researchers and administrative staff to increase their involvement in both established (e.g. Open Access to research publications, RDM and FAIR data) and emerging (e.g. responsible research assessment, preregistration) Open Science practices.

Universities should also expand training in the key skills needed for the transition towards Open Science (e.g. data skills) for researchers and administrative staff as for universities to embrace

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Open Science principles, policies and practices, there needs to be more in-depth understanding about Open Science. In the end, to embrace Open Science, universities and researchers need to embrace cultural change in the way they work, plan and operate. The result will foster a culture of Open Science in universities and may support other evolutions in academic practice, such as the use of next-generation metrics in the evaluation of research output.

Next steps: This report is first step for constructing comprehensive understanding of the Open Science practices (task 7.2) and creating new tools to accelerate Open Science practices (task 7.3). Next, we organize an interactive workshop for EC2U university administrative staff. The aim of the workshop is to discuss and share experiences about the Open Science practices at the university level. This information will be use to complement the case descriptions presented in this report.

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VIII. Annexes

A. Participant information sheet

Participant information sheet – Open EC2U: Stories of Open Science practices

Please read this participant information sheet and the accompanying data protection statement thoroughly. If you agree to participate in the study, please proceed to the data collection form by following the link below: https://redcap.utu.fi/surveys/?s=98CPXRRAMA4E4NA8.

General information on the project

This study is part of the project 'Research & Innovation for Cities & Citizens (RI4C2)', a joint project of the member universities of the EC2U Alliance (universities of Coimbra, Alexandru Ioan Cuza of Iași, Friedrich Schiller Jena, Pavia, Poitiers, Salamanca and Turku). The overall objective of the RI4C2 project is to strengthen collaboration and knowledge circulation in research and innovation within the EC2U Alliance and, finally, to create a shared Pan-European Knowledge Ecosystem.

The RI4C2 project has received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreement 101035803.

Purpose and significance of the study

Open Science has become a significant way to promote transparency and accessibility of scientific research and its effects and impact. Open Science is an umbrella term covering a wide range of practices, such as data sharing and FAIR data management, open access publishing, open code, open engagement of societal actors, open evaluation, participatory science and preregistration. Some of the practices are established and some are yet emerging. Awareness and practical implementation of Open Science practices vary across disciplines and organisations. Thus, identifying and sharing the best ways of implementing Open Science would benefit researchers and research organisations widely.

The study 'Open EC2U: Stories of Open Science practices' aims at identifying and establishing the best practices in Open Science. To reach our aim, we collect case descriptions from researchers and specialists in university administration who have adopted and engaged in Open Science practices in their academic and professional work. Collected case descriptions will be analysed to gain deeper understanding of Open Science practices being implemented at the EC2U partner universities.

How to participate

We invite you to write a case description about an Open Science practice you have implemented in your academic or professional work. In the case description, we will ask you to describe the carried out Open Science practice, reasons and motivations for engaging in the practice and the actual process of the implementation. Also, we will ask you to evaluate the process and give you an opportunity to provide ideas for its improvement.

Participation in the study and writing a single case description will take around 20–30 minutes. If you wish, you may provide multiple case descriptions.

Case descriptions of Open Science practices can be provided through the online data collection form until 11 March 2022. In the form, we will also enquire your interest in participating in a possible follow-up interview.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101035803

Voluntary participation

Participation in this study is entirely voluntary. You may decline to participate or withdraw from the study without providing an explanation at any time. If you decide to withdraw from the study, your data will be destroyed completely, and it will not be used in the project. You may withdraw from the study by informing a member of the project team.

How will your data be used?

The data collected in this study will be used to design and develop policy recommendations and tools that accelerate and mainstream Open Science practices at the EC2U partner universities. Publications will include policy briefs, Open Science guidebook, and possibly a conference article and a journal article. All publications will be made openly accessible.

We may use anonymised extracts from your case description in project outputs. Any non-anonymised data collected in this study will not be published or made openly accessible.

Risks and benefits

We do not expect the participation to cause any risks to the participants.

Participation in the study does not involve direct benefits to the participants. However, we expect that the study supports the participating universities in developing a broader and a more practical perspective towards supporting researchers in meeting the requirements of Open Science by identification and dissemination of best practices.

Data protection

Your personal data will be processed securely and following the regulations of the GDPR (2016/679). For the complete description of the processing of personal data in this study, please see the data protection statement on the front page of the data collection form.

Data storage and archiving

The collected data will be stored without direct personal identifiers on the University of Turku's own secured servers. The data is accessed by a personal, password protected organisational account, and only the members of the project team have access to the data. The data will be stored for 5 years after the completion of the project and destroyed in September 2029. Anonymised case descriptions from consenting participants and all metadata will be archived permanently in Zenodo.

Contact information

If you have any questions regarding this study or wish to receive more information on the RI4C2 project, do not hesitate to contact us.

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101035803

B. Data collection form

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RI4C2 Research & Innovation For Cities & Citizens

UNIVERSITY OF TURKU

Open EC2U: Stories of Open Science practices

Research Development Unit of The University of Turku invites you to participate in the study 'Open EC2U: Stories of Open Science practices'. The study is part of the project 'Research & Innovation for Cities & Citizens (RI4C2)', a joint effort of the seven member universities of the EC2U Alliance funded from the European Union's Horizon 2020 research and innovation programme.

The study 'Open EC2U: Stories of Open Science practices' aims at identifying and establishing the best practices in Open Science by collecting and analysing case descriptions about Open Science practices such as data sharing and FAIR data management, open access publishing, open code, open engagement of societal actors, open evaluation, participatory science and preregistration. The study is targeted at researchers and specialists working at the member universities of the EC2U Alliance.

Using this data collection form, we invite you to write a case description about an Open Science practice you have implemented in your academic or professional work.

The study will support the participating universities in developing a broader and a more practical perspective towards supporting researchers in meeting the requirements of Open Science by identification and dissemination of best practices.

General instructions for participating in the study

Please read the accompanying participant information sheet and the data protection statement before proceeding in the data collection form. The complete data collection form may also be downloaded and reviewed in PDF format below.

The form contains background questions and open text fields for providing the case description. The case description is divided into three subsections in which, we will ask you to describe and evaluate the carried out Open Science practice, reasons and motivations for engaging in the practice, and the actual process of implementing the practice.

Participation in the study and writing a single case description will take around 20–30 minutes. The number of characters and words is unlimited in the text fields. You may save an unfinished form and return later for its completion using the return code provided. If you wish, you may provide multiple case descriptions by filling in the form again.

There is no time limit to the completion of the form. However, to avoid losing data due to network problems, we recommend writing the case description in advance in a word processing software (e.g. Word, Notepad), and pasting it in its respective text fields on the form.

Please note that the data collection form also contains a file upload link which can be used for uploading a document depicting an existing process of your selected Open Science practice in your organisation (e.g. process chart, policy document, guide).

The data collection form is open until 28 February 2022.

Contact details

If you have any questions regarding this study or wish to receive more information on the RI4C2 project, do not hesitate to contact us.

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Jaakko Kuha
Development Specialist
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jaakko.kuha@utu.fi

Participant information sheet:

Attachment: Participant Information Sheet.pdf (0.15 MB)

Data protection statement:

Attachment: Data Protection Statement.pdf (0.14 MB)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101035803

Data collection form in PDF format:

Attachment: data-collection-form_DRAFT.pdf (0.1 MB)

Informed consent

1) I have read and understood the participant information sheet. I consent to participate in the study.
* must provide value
- ○ Yes
- ○ No

2) The data I provide may be archived in an anonymised form in an open repository (if you choose 'no', your data will not be archived).
* must provide value
- ○ Yes
- ○ No

3) I may be contacted for a possible follow-up interview about Open Science practices.
* must provide value
- ○ Yes
- ○ No

4) I participate in this study in the role of
* must provide value
- ○ Researcher
- ○ Specialist in university administration

Submit

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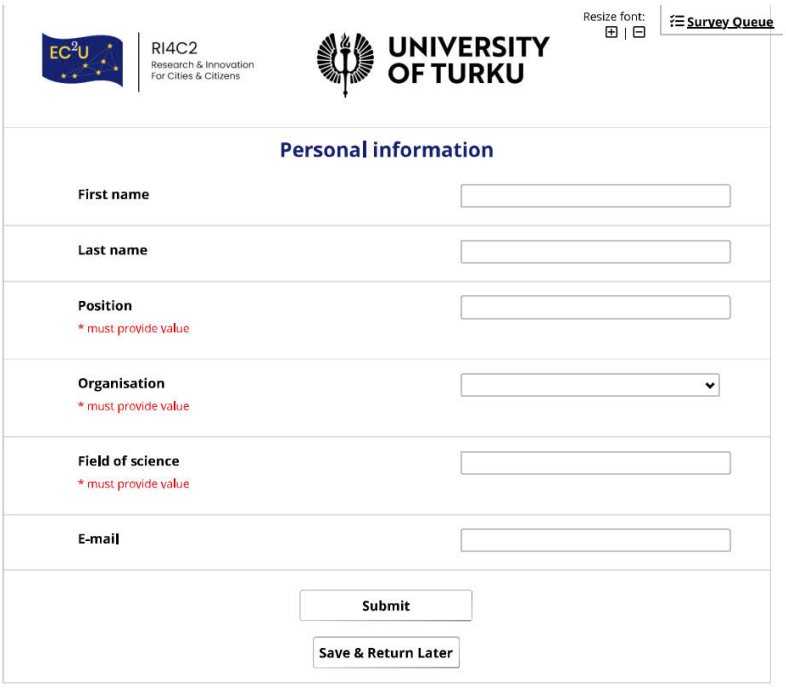

RI4C2
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For Cities & Citizens

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Survey Queue

Personal information

First name

Last name

Position
* must provide value

Organisation
* must provide value

Field of science
* must provide value

E-mail

Submit

Save & Return Later

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Survey Queue

Case description: Background questions

In this section, we request you to answer both background questions indicating your engagement in open science practices.

What open science practice(s) have you engaged in within the last 3 years? Please check all applicable options	**Which open science practice are you going to write a case description about?** Please select one
☐ Citizen science	○ Citizen science
☐ Collaborative bibliographies	○ Collaborative bibliographies
☐ Crowdsourcing	○ Crowdsourcing
☐ Data sharing	○ Data sharing
☐ FAIR data management	○ FAIR data management
☐ Journal club	○ Journal club
☐ Open access publishing	○ Open access publishing
☐ Open access research instruments / equipment	○ Open access research instruments / equipment
☐ Open code	○ Open code
☐ Open educational resources	○ Open educational resources
☐ Open evaluation and peer review	○ Open evaluation and peer review
☐ Open hardware	○ Open hardware
☐ Open innovation	○ Open innovation
☐ Open lab books	○ Open lab books
☐ Open notebooks	○ Open notebooks
☐ Open research infrastructures	○ Open research infrastructures
☐ Open research methods and protocols	○ Open research methods and protocols
☐ Open science communities	○ Open science communities
☐ Open science education	○ Open science education
☐ Open science infrastructures (development of e.g. archives, digital research environments, platforms, repositories)	○ Open science infrastructures (development of e.g. archives, digital research environments, platforms, repositories)
☐ Open science policymaking	○ Open science policymaking
☐ Open science working groups	○ Open science working groups
☐ Open source software	○ Open source software
☐ Participatory science	○ Participatory science
☐ Preprints	○ Preprints
☐ Preregistration	○ Preregistration
☐ Science outreach and communication	○ Science outreach and communication
☐	○ Other
☐	
☐	
☐	
☐	

Case description: General instructions

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In this section, we request you to write a case description about an optional open science practice that you have implemented.

The case description is divided into three subsections:

- **What?**
  - Specify briefly the open science practice you engaged or were involved in
- **Why?**
  - Describe briefly the reasons and motivations for engaging in the open science practice
- **How?**
  - Write a detailed description of the actual process of the practical implementation of the open science practice
  - Evaluate the process of the implementation of the open science practice

Example questions you may address in your case description are provided above each text field.

There is no limit to the length of the case description. Your description may be as brief or as extensive as you wish. However, we wish that you describe the process as rigorously as possible.

To avoid losing data due to a network problem, you may write your case description in a word processing software (e.g. Word, Notepad) in advance, and paste each subsection in their respective text fields.

Anonymised extracts from your case description may be used in reports and other outputs of the RI4C2 project.

Please note: If your organisation has an existing process for your selected open science practice (_____), you may upload a document depicting the process using the upload link on the right (e.g. process chart, policy document, guide).

Case description: What?

Please specify briefly the open science practice you engaged or were involved in (your selection: _____)

In your description, you may address the following example questions:

- What was the open science practice you carried out?
- What kind of details were associated with the open science practice?
- What was your previous experience with the open science practice?

The text field expands automatically if you press the 'Expand' button in bottom right corner of the text field after entering text in the field.

Case description: Why?

Describe briefly the reasons and motivations for engaging in the open science practice (your selection: _____)

In your description, you may address the following example questions:

- What motivated you to engage in this open science practice?
- What kind of effects or impacts were you expecting when you engaged in this open science practice?

The text field expands automatically if you press the 'Expand' button in bottom right corner of the text field after entering text in the field.

Case description: How?

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Please write a detailed description of the actual process of the practical implementation of the open science practice (your selection: ____)

In your description, you may address the following example questions:

- What were the key actions you took when implementing the open science practice?
- What guidelines, policies, recommendations did follow in the process?
- What support services did you utilise over the course of the process?
- What infrastructure did you use (e.g. platforms, repositories, harware, software)?
- How was the process?
  - What went well? What did not?
  - What challenges did you encounter in the process?
  - How could the process be improved?

The text field expands automatically if you press the 'Expand' button in bottom right corner of the text field after entering text in the field.

Submit

Save & Return Later

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C. Data protection statement

UNIVERSITY OF TURKU

Data Protection Statement
The EU General Data Protection Regulation
(EU 2016/679), articles 13 and 14

Date: 2.2.2022

Information for participants on the project 'Open EC2U: Stories of Open Science practices'

You are taking part in a study conducted at the University of Turku. This privacy notice specifies how and for what purposes your personal data will be processed in the study.

1. Data Controller

University of Turku
FI-20014 TURUN YLIOPISTO
FINLAND
E-mail: kirjaamo@utu.fi
Telephone: +358 02 450 5000 (switchboard)
Fax: +358 029 450 5040
Business ID: 0245896-3

Contact person in matters concerning the project:
Name: Laura Niemi
Telephone: +358 50 435 9029
E-mail: laura.niemi@utu.fi

2. Description of the study and the purposes of processing personal data

The study aims at identifying and establishing the best practices for the practical implementation of a range of Open Science practices. In the study, we will collect case descriptions from researchers and specialists working in university administration who have implemented Open Science practices in their own academic and professional work. The participants are researchers and staff members from the seven partner universities of the EC2U Alliance (University of Coimbra, Alexandru Ioan Cuza of Iași, University of Friedrich-Schiller University Jena, University of Pavia, University of Poitiers, University of Salamanca, University of Turku).

We collect the field of science or service unit, the position and the name of the organisation from all participants as background information. The background information is needed in the analyses of the case descriptions, and to provide policy recommendations to the partner universities in developing their existing processes concerning Open Science. Case descriptions together with the collected background information may enable indirect identification of a participant. Additionally, full name and e-mail address will be collected from the participants who voluntarily agree to being contacted for a possible follow-up interview. These direct personal identifiers will be used solely for the purpose of contacting participants.

3. Project team

Name: Mari Riipinen (WP Leader)
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Telephone: +358 40 577 9273
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Research Development Unit, University of Turku
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UNIVERSITY OF TURKU

Data Protection Statement
The EU General Data Protection Regulation
(EU 2016/679), articles 13 and 14

Date: 2.2.2022

4. Contact information of the Data Protection Officer

E-mail: dpo@utu.fi
Further information: www.utu.fi/dpo

5. Persons processing personal data in the study

Only the members of the project team participate in the processing of personal data. Personal data will not be shared outside the project team.

6. Name and duration of the study

Name of the study: 'Open EC2U: Stories of Open Science practices'

Duration of the processing of personal data: 1.1.2022 - 31.8.2024.

All direct personal identifiers collected in the study will be destroyed at the latest in September 2024, immediately after the completion of the project. The data not containing direct identifiers (case description, participant's field of science or service unit, position, organisation) will be stored for 5 years after the completion of the project and will be destroyed in September 2029. Anonymised case descriptions from consenting participants will be archived permanently in Zenodo.

7. Lawful basis of processing

Personal data is processed on the following basis, which is based on Article 6(1) of the General Data Protection Regulation:

- ☐ data subject's consent;
- ☐ processing is based for the performance of a contract;
- ☐ compliance with a legal obligation to which the controller is subject;
- ☐ processing is necessary in order to protect the vital interest of the data subject;
- ☐ performance of a task carried out in the public interest or in the exercise of official authority vested in the controller:
  - ☐ scientific or historical research purposes or statistical purposes;
  - ☐ archiving of research materials or cultural heritage materials;
- ☒ legitimate interest pursued by the controller or by a third party

7. Legitimate interests of the data controller or a third party

The processing of personal data is based on the mission of the University as laid down in Article 2 of the Universities Act (558/2009). In addition, based on the legitimate interest described in Article 6 of the General Data Protection Regulation (2016/679), the information will be used to support the partner universities of the EC2U Alliance in building capacities and developing ways of promoting and monitoring Open Science and connecting science to society.

8. Personal data included in the data and protective measures

We collect the field of science or service unit, the position, the name of the organisation, and the case description from all participants. Case descriptions together with the aforementioned background information may enable indirect identification of a participant. Full name and e-mail address will be collected from the participants who consent to being contacted for a possible follow-up interview. The consent is obtained separately on the data collection form.

1290 UNIVERSIDADE D COIMBRA
UNIVERSITATEA „ALEXANDRU IOAN CUZA" din IAȘI
FRIEDRICH-SCHILLER-UNIVERSITÄT JENA
UNIVERSITÀ DI PAVIA
Université de Poitiers
VNiVERSiDAD D SALAMANCA
TURUN YLIOPISTO

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101035803

UNIVERSITY OF TURKU

Data Protection Statement
The EU General Data Protection Regulation
(EU 2016/679), articles 13 and 14

Date: 2.2.2022

The data is collected using REDCap data collection tool. REDCap is a secure web application based on source code openly available to all member organisations of the REDCap consortium including the University of Turku. REDCap used at the University of Turku is provided from server facilities owned and operated by the University of Turku IT Services.

Direct identifiers will be removed from the data in the end of the data collection phase and stored separately from the data used in the analyses. The data will be stored and backed up in the secured cloud service Seafile provided by the University of Turku IT services. By adhering to this procedure, we are able to guarantee that the data will be kept safely on the University's own servers. The Seafile folder is accessed by a personal, password-protected organisational account, and only the members of the project team are given access rights to the folder.

9. Sensitive personal data

Sensitive personal data will not be collected in the study.

10.Sources of personal data

Personal data is collected directly from the participants. No other sources of personal data are used.

11. Information on transferring personal data to third parties

Personal data will not be transferred to third parties.

12. Information on transferring personal data to countries outside the EU or the European Economic Area

Personal data will not be transferred to countries outside the EU or the European Economic Area.

13. Automated decisions

Registered data will not be used for automatic decision making or profiling.

Safeguards to protect the personal data:

☐ The data is confidential.
☐ Protection of manual material:
☒ Personal data processed in IT systems:
The data is collected using REDCap data collection tool provided from server facilities owned and operated by the University of Turku IT Services. The data will be stored and backed up in the secured cloud service Seafile provided by the University of Turku IT services. The Seafile folder is accessed by a personal, password-protected organisational account, and only the members of the project team are given access rights to the folder.
☐ other

Processing of direct identifiers:

☒ Direct identifiers will be removed in the analysis phase
☐ The material to be analysed includes direct identifiers.

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UNIVERSITATEA „ALEXANDRU IOAN CUZA" din IAȘI
FRIEDRICH-SCHILLER-UNIVERSITÄT JENA
UNIVERSITÀ DI PAVIA
Université de Poitiers
VNiVERSiDAD D SALAMANCA
TURUN YLIOPISTO

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14. Processing of personal data after the completion of the study

The research material will be archived:

☒ without identifiers
☐ with identifiers

All direct personal identifiers collected in the study will be destroyed at the latest in September 2024, immediately after the completion of the project. The data not containing direct identifiers (case description, participant's field of science or service unit, position, organisation) will be stored for 5 years after the completion of the project and will be destroyed in September 2029. Anonymised case descriptions from consenting participants will be archived permanently in Zenodo.

15. Rights of the data subject

As a data subject, you have the following rights:

☒ Right to obtain information on the processing of personal data (GDPR Articles 13 and 14)
☒ Right of access (GDPR Article 15)
☒ Right to rectification (GDPR Article 16)
☒ Right to erasure (GDPR Article 17)
☒ Notification obligation regarding rectification or erasure of personal data or restriction of processing (GDPR Article 19)
☒ Right to restriction of processing (GDPR Article 18)
☒ Right to object (GDPR Article 21)

For more information on your rights as a data subject, you may contact Laura Niemi (laura.niemi@utu.fi).

Right to lodge a complaint

You have the right to lodge a complaint with a supervisory authority if you think your personal data has been processed in violation of applicable data protection laws.

Contact information of the Data Protection Ombudsman:

Office of the Data Protection Ombudsman
Visiting address: Lintulahdenkuja 4, 00530 Helsinki
Postal address: P.O. Box 800, 00531 Helsinki, Finland
Telephone: +358 29 566 6700 (switchboard)
E-mail: tietosuoja@om.fi

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