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CHIST-ERA

The European Open Science Policy Landscape

Status and Trends

September 2022

Foreword

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Open Science has been a political priority for the European Commission since a number of years. The Commission is a frontrunner in this area since the publication in 2012 of the Recommendation on Access to and Preservation of Scientific Information, which was revised in 2018 to cover a broader spectrum of open science practices. The Recommendation, the development of the European Open Science Cloud (EOSC) and many other relevant research and innovation policies have played a major role in facilitating the transition to open science in the European Union. They have inspired and supported the adoption of relevant policies by countries, research performing and research funding organisations.

The COVID-19 pandemic further demonstrated the urgency of opening science and its outputs. The unprecedented open collaboration and sharing of knowledge contributed in our response to the pandemic and to the fastest vaccines ever developed in history. While reinforcing the perception that open science accelerates scientific discovery, the pandemic also shed light on the need to promote its more systematic uptake.

Under the new European Research Area (ERA), and through the implementation of Horizon Europe, the Commission is leading by example in accelerating the transition towards open science as the new normal. The ERA Policy Agenda for 2022-2024 features three main actions that support this transition, namely the development of the European Open Science Cloud (EOSC), working towards a copyright and data legislative framework that is fit for research, and the reform of research assessment to recognise a diversity of outputs, activities and practices in research, including those contributing to transparency and openness.

As a research funding organisation, the European Commission has made Open Science the modus operandi of Horizon Europe, the EU Framework Programme for Research and Innovation for the period 2021–2027. Horizon Europe features the most comprehensive approach to open science that we have ever seen. It mandates immediate open access to publications, responsible research data management, and data sharing under the principle 'as open as possible, as closed as necessary'. As an important novelty, Horizon Europe incentivises and mainstreams open science practices by taking proper account of them in the evaluation of proposals and at the reporting of projects.

I congratulate CHIST-ERA members for supporting the transition towards open science. Research funding organisations have a crucial role in promoting open science practices through the setting up and implementation of clear policies and incentives. I am delighted to see that the majority of CHIST-ERA members have comprehensive open science policies in place and that this number is continuously growing. This report is testimony of your efforts and willingness to effect positive change and improve our research systems. We look forward to working together towards developing and mainstreaming open science.

* * *

Oscar Corcho

Professor at Universidad Politécnica de Madrid

Open Science can nowadays be considered a reality (or a commodity) for researchers, research performing organisations and research funding organisations, among many other stakeholders. My experience on Open Science matters is twofold:

- As a researcher (and practitioner), I try to apply Open Science principles as much as possible in the work that we carry out. Our main reason for applying Open Science is probably the reproducibility of our experiments. So this is not only relevant in the work that we do in our research group but also in all of our collaborations with other research groups worldwide. I can confirm that our efforts towards making all the research artefacts used in our experiments widely available and explicit pays off in the medium and long term, ensuring that we do not repeat once and again the same work.
- As the leader of the Open Science community inside a research performing organisation (Universidad Politécnica de Madrid), I have the task of making sure that the university has a clear roadmap towards Open Science that goes beyond open access and that it takes into account the different characteristics of the varied research areas that are covered by all of my colleagues. We have run many interviews and surveys to understand those needs and opportunities, we have been training early stage researchers on Open Science, and have now a roadmap that is shaping how Open Science is done at our university.

Taking this into account, I really appreciate the efforts that research funding organisations such as those involved in CHIST-ERA are making towards making Open Science a new norm in scientific research. In fact, this report does not only show a status-quo towards Open Science where a large majority of the CHIST-ERA members are adopting Open Science policies, but also a clear evolution in the last few years that shows that Open Science is achieving a high level of maturity among research funding organisations.

One aspect that I have found especially interesting when reading the report is the evolution in terms of considering open research data (understood in a broad sense, considering not only data but also other research artefacts such as software) as a key element in Open Science, beyond the well-known open access model for publications. This is key in the next steps to be done in this area, and CHIST-ERA members are already positioning in this respect,with upcoming funding calls focused on this.

Authors

This report has been created in the framework of the CHIST-ERA Open Science working group by Lucie Rosecká (Technology Agency of the Czech Republic, *TACR*) and Ahmad Zein Assi (Swiss National Science Foundation, *SNSF*).

Acknowledgements

We would like to warmly thank Michaela Křiklánová for her important contributions to the early stages of the analysis. We would also like to thank the members of CHIST-ERA for their inputs that allowed this analysis to be performed. This work is part of the research framework of CHIST-ERA, which is supported by the European Commission through the Horizon 2020 Grant 857925.

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Executive Summary

Opening science and its outputs is gaining increasing attention from politicians as well as researchers. Being conscious and concerned by its importance, CHIST-ERA carried out an analysis among its member agencies regarding their national Open Science policies and practices. For this, surveys were conducted in 2019, 2020 and 2021. The analysis is structured in two parts. The first one summarises the Status Quo in 2021, while the second part compares the evolution of the policies between 2019 and 2021.

To date, a majority of the funding organisation in CHIST-ERA already have an Open Science policy and has institutionalised the latter through the appointment of an Open Science officer. However, the policy does not always apply across all funding programmes of the respective organisations. In addition, over two-thirds of funding organisations are members of one or more international networks promoting Open Science. This shows that those international networks are widely regarded as important for the promotion and implementation of Open Science best practices.

For Open Access to publications, the green and gold routes are the most popular recommended ones. Furthermore, most funding organisations can cover the corresponding publication fees as well as costs of data sharing in repositories, mainly without specific upper limits. While embargo periods are generally regarded as obstacles to be avoided, more than half of the funding organisations still allow embargos for the publication of papers and research data. The practices within funded projects are generally monitored through progress reports and Data Management Plans.

The analysis shows that the Open Science landscape is rather mature. In particular, by analysing the correlations between the different aspects covered by the analysis, we show that the handling of embargos should be treated with high priority, as this can be an obstacle to the open dissemination, reproducibility and efficiency of research. This can be partially explained by the fast pace in which Open Science practices are being developed and recommended by international networks and policy makers. Nevertheless, by observing the evolution of the landscape in the last couple of years only, it is clear that the current status is itself driven by a constant evolution that is expected to bring it to a much more mature stage in the near future, especially through new policy developments, and particularly at the level embargos for OA publications and ORD sharing.

Indeed, the main conclusion of the present analysis between 2019 and 2021 is that Open Science is becoming part of the policies and regulations of member funding organisations. More precisely, the number of funding organisations with an Open Science policy is increasing over the years. Open Access to publications fees as well as costs for the open sharing of research data are also increasingly being supported by the funding organisations. The latter continue to prefer the green and gold routes and are less willing to allow embargo periods. On the other hand, requiring a DMP from project beneficiaries is becoming a standard, as much as sharing research data in specific data repositories. Finally, the number of declared Open Science officers is also increasing, which shows how Open Science is being anchored within the administrative organisation of the funding organisations.

CHIST-ERA will continue monitoring the Open Science landscape in the upcoming years with the aim to confirm our prediction of a more mature landscape in the horizon of 2024–2025.

Introduction

The openness of Science is key to ensuring its transparency and reproducibility. It has been gaining increasing importance with the formalisation of the concept of Open Science. Chronologically, the focus was first on Open Access to publications and has been ever since slowly moving toward Open Research Data.

Being a vector of scientific excellence in Europe and beyond, CHIST-ERA is aware of the importance of Open Science and is proactively committed to its principles (CHIST-ERA, 2020). The level of commitment to Open Science of its members funding organisations is quite heterogeneous in terms of national policies and research frameworks. This has been transparent through the different analyses of the European Open Science landscape conducted by CHIST-ERA in 2019, 2020 and 2021.

In the course of framing the CHIST-ERA Open Science policy (CHIST-ERA, 2021), one of the challenges was to set an encompassing framework based on the existing national practices. For this, and given the lack of up-to-date and centralised data, CHIST-ERA filled in this gap by yearly surveying its members since 2019. Given the instrumental role it has played, the goal of the present work is to shed light on the maturity of the European Open Science landscape today and how it has evolved in the past couple of years. In doing so, we hope that it will help funding organisations and policy makers position themselves at the forefront of the best practices, but also enable researchers to better utilise better available opportunities and support.

The last survey was conducted between July and September 2021 and gathered data of 27 funding organisations coming from 25 countries. Some information was updated in March 2022 for completeness.

In the first part of the present work (Chapter I), we present the latest available Status Quo based on a simple statistical evaluation of individual answers. In several cases, we analyse the interrelationships between the different aspects of OS Policy using the Pearson correlation between well-defined binary variables. For completion, an overview of features per funding organisation is presented in the annex.

In the second part of the work (Chapter II) we analyse the evolution of the policies within the same landscape over time based on similar surveys conducted in 2019 and 2020. Here, the goal is twofold. On the one hand, we assess how the maturity of the landscape has evolved in the past few years. On the other hand, we extrapolate the results for the next few years, anticipating possible future directions in which the funding organisations are likely to evolve.

It is important to stress that this report is based on the latest data collected in 2021 (and verified in 2022), so that it may not reflect very recent development in the Open Science landscape. Based on a recent consultation of the funding organisations, it is expected that the analysed data is still up-to-date.

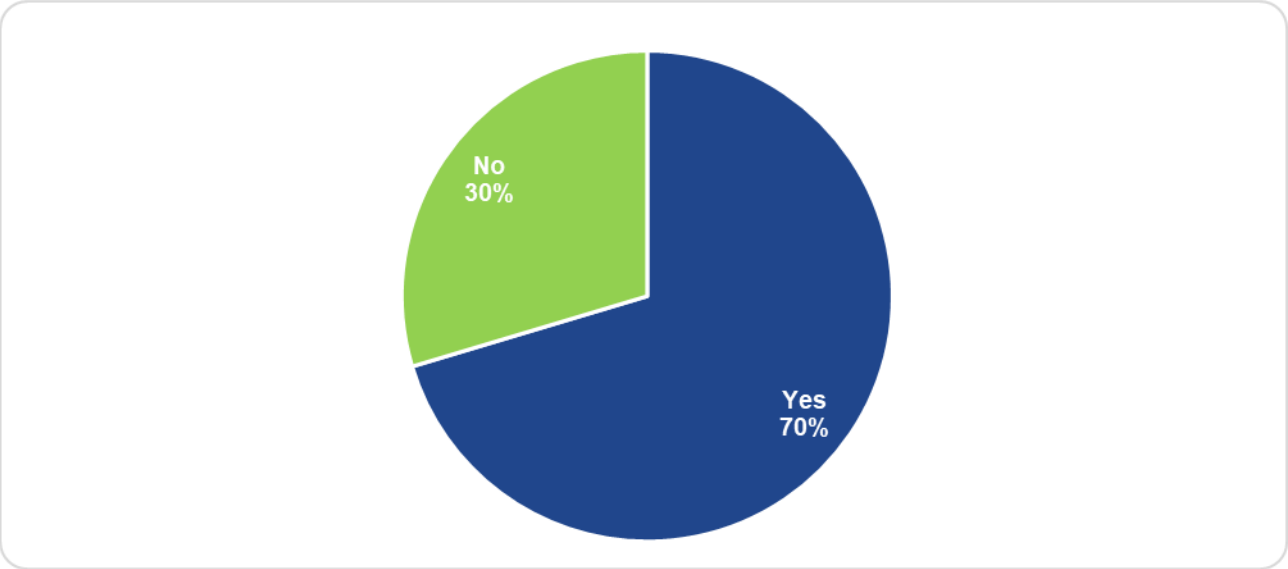
Chapter 1: The European Open Science Landscape

This section forms the basis of the analysis and maps the funding organisations' approach to Open Science Policy and practices that funding organisations set for projects and researchers. It also deals with the services they provide to them in an effort to promote Open Access to publications (OA) and to research data (ORD). In what follows, we analyse Open Science (OS) from the point of view of OA and ORD viewed as its main defining components.

The data collected from the funding organisations are statistically evaluated and thus provide a general overview of the current status. For some components of particular importance, we also present the data of the individual funding organisations for an overview. We also perform a comparison between different components that are factually related.

Part 1: Funder OS Policy & Support for Researchers

Chart 1 Do you as a funding organisation have an Open Access policy (meaning that the researchers have to make their publications openly available)?



In 2021, 70% funding organisations had an Open Access policy (meaning that the researchers have to make their publications openly available). Links to the respective OS Policies of member agencies can be found in Annex 3.2.

However, the content and application of the different policies is rather heterogeneous. For instance, 62% of the organisations the policy is applied to all their funding programmes while for 15% of them it applies only in some programmes.

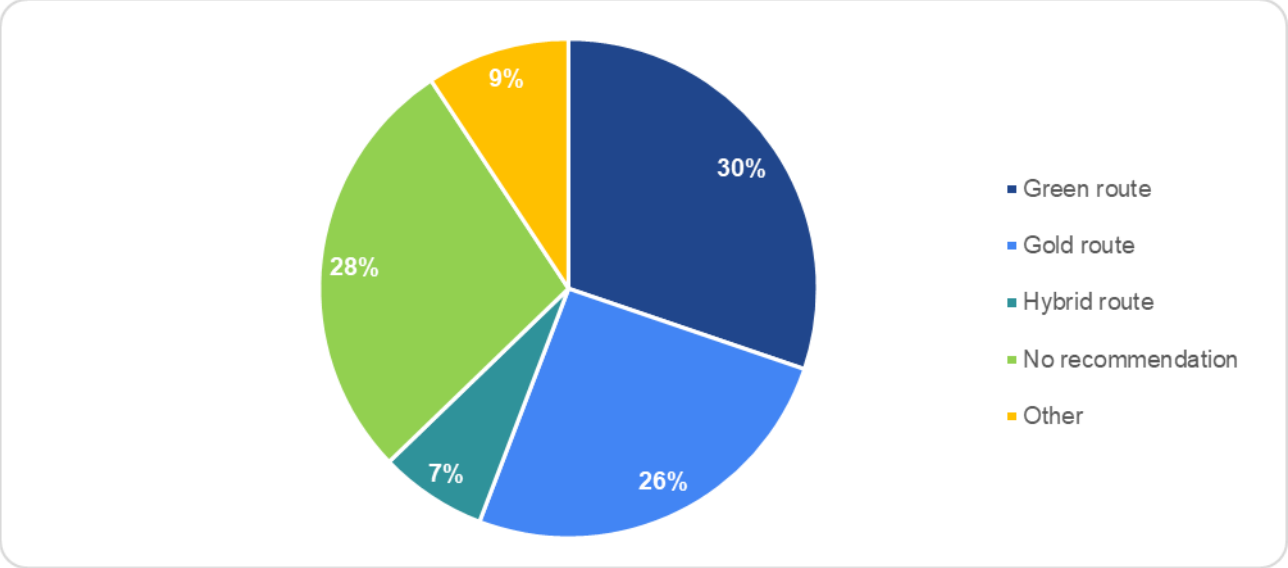
To illustrate this, we provide below some instances where OS is applied only in some programmes.

- ERA-NETs Cofund, Programmes funded from Structural Funds (GSRT)
- Kappa programme funded with EEA grant (TACR)
- Academic R&D Supports (TÜBITAK)

For FFG, Open Access is not obligatory but only a preferred option in all its programmes, mainly when research organisations are involved. It is not included in small formats such as innovation vouchers or in closer to the market instruments. This explains the discrepancy in total sum.

The example of GSRT (Greece) highlights the importance of programmes like CHIST-ERA, which can be a catalyser triggering further developments in OS.

Chart 2 Do you propose recommendations on how publications should be accessible?



The Open Access policy in a funding agency usually includes a recommendation or a requirement for a certain way of publishing (several options possible per organisation). Other routes are also standard (*e.g.* hybrid route) or becoming so (*e.g.* Diamond route). Some funding organisations are explicit and relatively strict, while others offer no recommendations or do not specify the conditions. The category "other" includes additional possibilities or requirements.

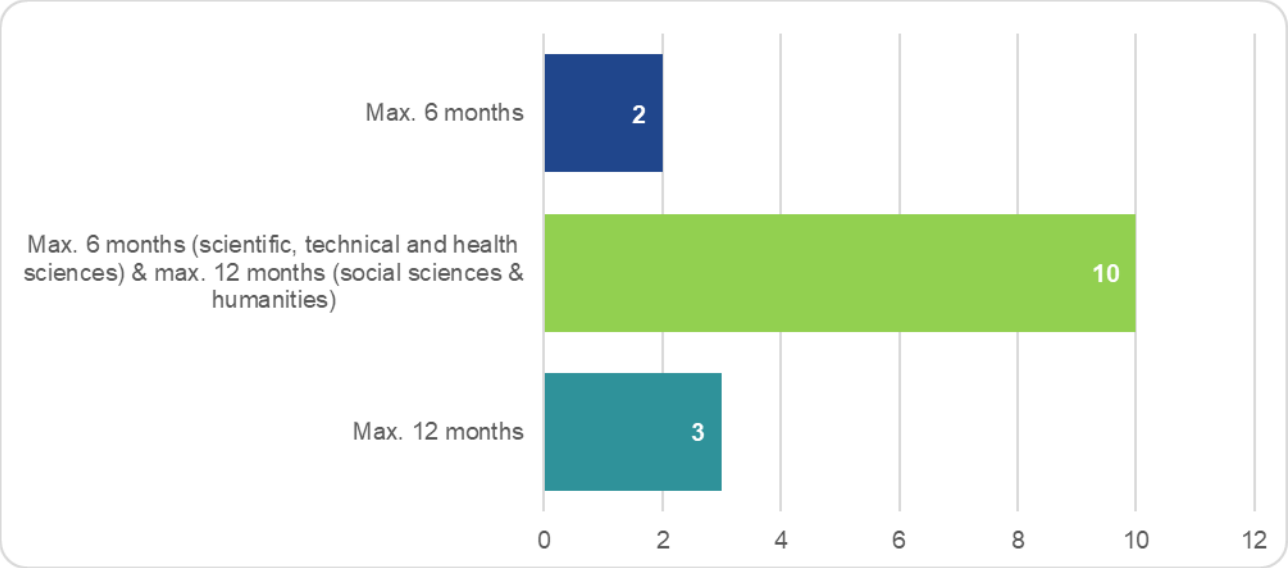
More than half of funding organisations propose recommendations on how publications should be accessible, the green and gold routes being the most popular. Note that a non-negligible fraction (28%) of the organisations do not give any recommendation.

An embargo designates a period of time during which a publication or research data are retained, i.e. not openly available. In practice, some publication venues impose embargo periods upon which authors are free to make a publication openly available, usually on an open repository.

The trend in recent years is to set up a maximum period for the embargo, or even require immediate access to the publication. Aligned with the recommendations of Coalition S[1] (cOAlitionS, 2018) and the policy of the European Commission, one third of organisations do not allow any embargo. When allowed, embargos are often limited to 6 months for scientific, technical and health sciences and 12 months for humanities and social sciences.

[1] *cOAlition S is an initiative to make full and immediate Open Access to research publications a reality. It is built around Plan S, which consists of one target and 10 principles. Members of cOAlition S are European Commission, ERC and several national funders.*

Chart 3 If self-archiving of publications is allowed, do you have specific embargo periods? How long?



OA is one facet of OS, the other one being Open Research Data (ORD). This refers to the research data underlying a publication. Open here means making it available on an appropriate repository. We define Research data as *the evidence that underpins the answer to the research question, and can be used to validate findings regardless of its form (e.g. print, digital, or physical)* (CORD, 2016). ORD is a younger avenue and is therefore less mature. We now focus on the embargo periods for ORD.

Table 1 Comparison of Embargo for OA and ORD

Embargo for publications allowed	Embargo for research data allowed
66%	78%

It is evident that the number of funding organisations allowing embargos on publications and research data is comparable. However, there is no clear correlation between embargos in specific funding organisations. This is also confirmed through statistical correlation analysis (see Part 5 below).

Data management Plans

Data Management Plans (DMPs) are a key element towards good data management. A DMP describes the data management life cycle for the data to be collected, processed and/or generated by a project. They usually include descriptions of data that will be collected or generated, the handling of research data during and after the end of the project, whether data will be shared or made openly available and how data will be curated & preserved (including after the end of the project).

Not only the European Commission (EC) but also other funding organisations are gradually requiring researchers to develop a DMP. At the same time, they also require data to be shared on an open repository.

Currently, while 56% funding organisations ask their researchers to produce a Data Management Plan, only 44% require their data to be published on a repository (for details regarding the policies of specific agencies, see the overview table in Part 5).

Table 2 Comparison of DMP, ORD and Embargo for data (in %)

DMP obligatory	Open Research Data required	Embargo for data allowed
56	44	78

Guidelines and webinars

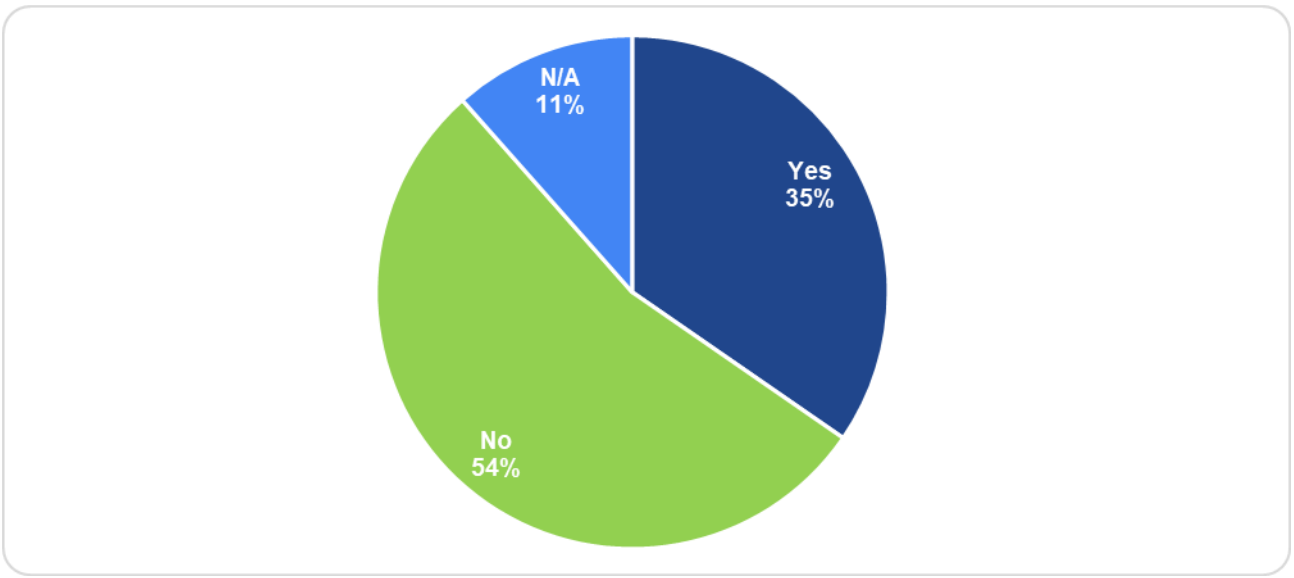
Given the relative novelty of Open Science policies and the diversity in the required practices, funding organisations usually provide guidelines and guidance to researchers.

Table 3 Comparison of Guidelines on OA and ORD

OA Guidelines provided	ORD Guidelines provided
63%	56%

The table compares the availability of guidelines for researchers on Open Access on one side and on Open Research Data on the other side. We notice that there are more funding organisations offering guidelines for OA to publications than funding agencies offering ORD guidelines. However, clear from Table 4, those funding organisations are not always the same. Our interpretation is that the level of maturity of the different funding organisations is very heterogeneous. Indeed, given that open access to publication is better understood and practiced in general, there is a higher need for open research data guidelines. The organisations providing only open research data guidelines are very likely to be relatively more at the forefront of open science best practices. On the other hand, those providing guidelines for open access only are expected to be less advanced in terms of open science.

Chart 4 Do you organise Open Access/Open Data webinars?



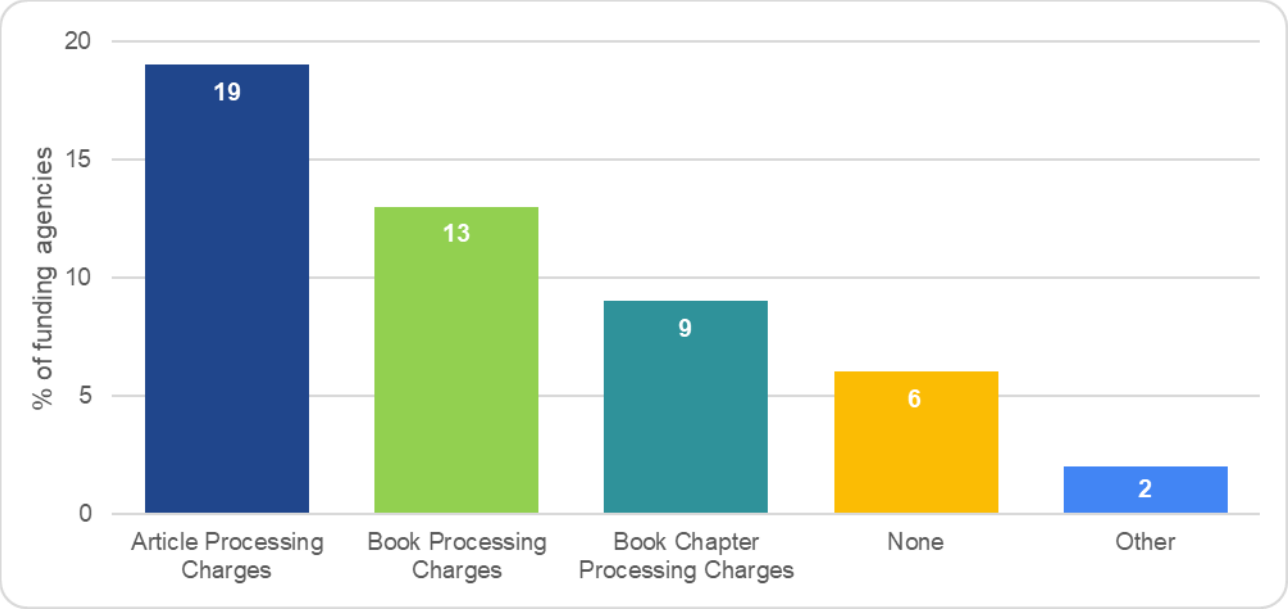
Thirty-five percent of the funding organisations organise Open Access or Open Research Data webinars. They organise them irregularly, when significant changes are implemented. Some funding organisations participate in or recommend activities organised by others.

Part 2: Open Access Fees

OA publications and ORD are available free of charge for the user, but they generally incur costs for researchers. This includes costs of publishing (especially in the gold route) and storing publications or data in a repository. The researcher must also prepare the publication and data in a suitable form.

This part describes various types of OA and ORD fees that can be supported by funding organisations.

Chart 5 Supported Open Access fees



The majority of funding organisations can cover Open Access publication fees. Article Processing Charges are the most popular charges funding organisations can cover – 40% of funding organisations can cover it. About one quarter of the funding organisations do not cover any of Open Access costs.

Most organisations (83%) do not set any specific limit on Processing Charges. Other organisations have specific conditions as outlined below.

- FWF has specific limits on supported costs depending on the type of publication and venue, see (FWF, 2022) and (FWF).
- NCN has no specific cap and grantees can use up to 2% of overheads for these charges. If needed, the grantees can cover the fees from "general overheads" (20% of the direct costs).
- FNR has specific limits depending on the route (*e.g.* 2500€ for Gold OA)
- F.R.S.-FNRS has an upper limit of 750€
- UKRI provides annual block grants to research institutions/universities to cover the cost for OA publications. This is for the research institutions to manage and allocate. Cost for OA publications cannot be requested on individual grants.

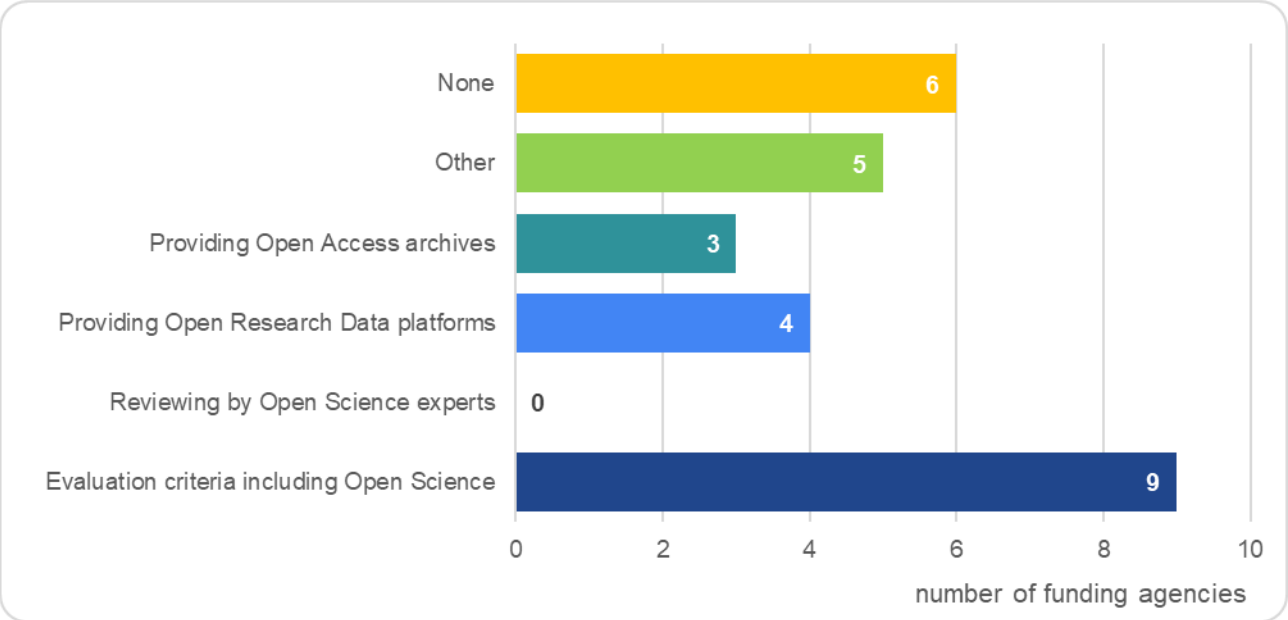
Financial support of open sharing of research data

In the case of data, 70% of funding organisations can financially support open sharing of research data, generally without any upper limit. Only in exceptional cases limits do apply. For instance, the SNSF financially supports data preparation and archiving data on data repositories complying with the FAIR data principles up to 10'000 CHF per research grant.

Part 3: Non-monetary tools to promote OS

Open Science can be supported in various ways. One of them is the financial support, which we analysed in the previous section. However, the possibilities for funding organisations are much wider. They can recommend an open approach, require it in the conditions of competitions, consider it in the evaluation of projects, recommend suitable tools, organise trainings and seminars. We now analyse the use of some of these incentives.

Chart 6 What tools do you use to support Open Science?



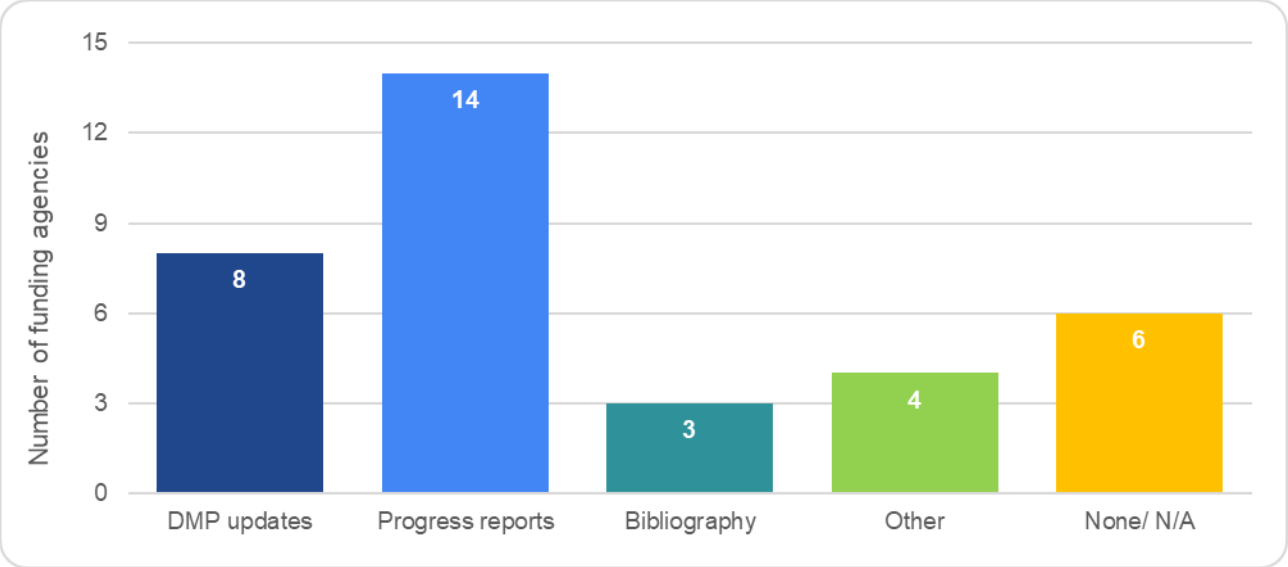
Funding organisations use both monetary and non-monetary tools to promote Open Science. One third of the funding organisations include Open Science within the evaluation criteria. Note that CHIST-ERA explicitly includes Open Science in its evaluation criteria since the Call 2019 (CHIST-ERA, 2019). 22% of the organisations do not use any non-monetary incentives. Some organisations use other specific non-monetary tools like the following.

- ANR makes available an online DMP tool (OPIDoR) and has set a specific portal in the national repository HAL (ANR).
- Swedish Research Council and Academy of Finland: Open Science is compulsory.
- The SNSF is a member of Europe PMC (providing SNSF grantees access to their OA repositories).

Note that no organisation systematically employs OS experts in the evaluation process. This indicates that OS is not treated as an evaluation criterion of the same importance as other standard criteria such as Excellence or Originality. This is not surprising since the basis of funding decisions is based on the latter standard criteria, while OS is rather a transversal aspect. Nevertheless, it would be interesting to explore whether evaluation panel members are trained on OS best practices as part of their mandate.

The possible ways of monitoring Open Science are diverse. Chart 7 summarises the types of monitoring tools used for following-up the application of the Open Science practices.

Chart 7 What types of monitoring tools do you use for following-up the application of the Open Science practices?



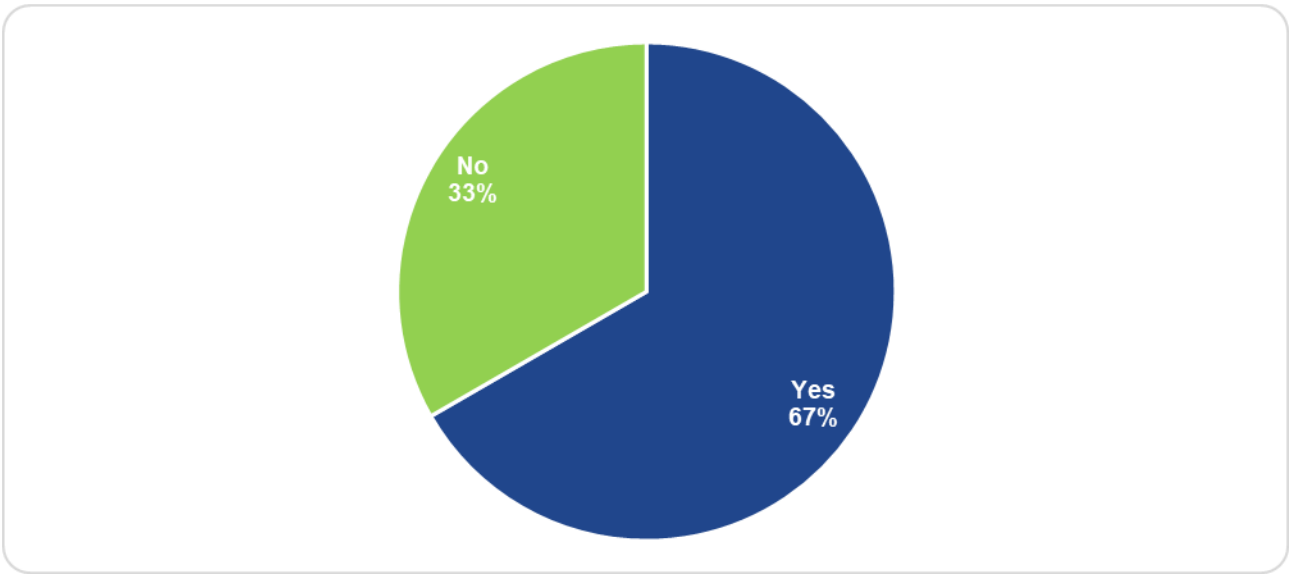
The most frequent monitoring tools used for following-up the application of the Open Science practices are progress reports (40%) and DMP updates (23%). About one quarter of funding organisations do not mention any monitoring tools. Four funding organisations have other specific monitoring tools.

- TA CR requires principal investigators (PI) to provide references and an abstract of all scientific publications relating to the results of the project at the latest 60 days following publication.
- Research Council of Lithuania monitors through mid-term and final project evaluations.
- SNSF: The SNSF offers a service for researchers to check their individual Open Access status (SNSF).

It is clear that *Monitoring* is one of the biggest challenges for funding organisations in following-up on the implementation of national funding regulations. As can be seen from the examples above, there is a variety of tools, some of which are currently under discussion or evaluation. This begs for a comprehensive - possibly pan-European - solution ensuring an efficient and reliable monitoring of OS practices at the project level. As part of the European landscape, CHIST-ERA is currently testing a solution provided by OpenAIRE for the monitoring of project beneficiaries (OpenAIRE).

Part 4: Other Open Science Initiatives

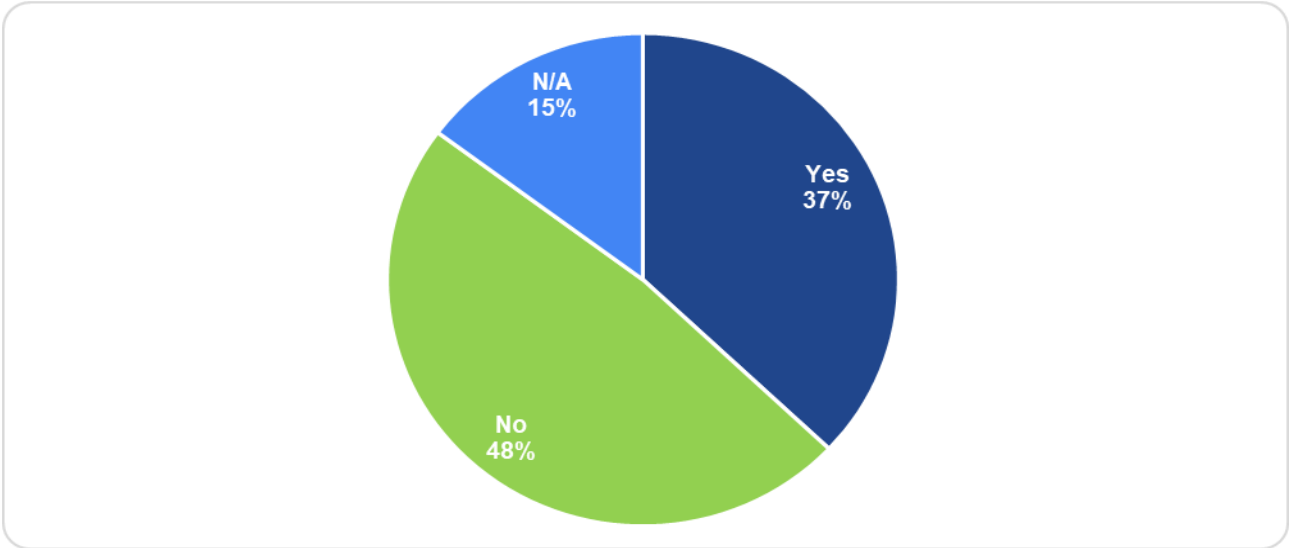
Chart 8 Is your organisation a member of any international network promoting Open Science? (like Science Europe)



Two-thirds of funding organisations are members of one or more international networks promoting Open Science. Science Europe, EOSC and CoalitionS are the most popular ones. Other networks or initiatives include DORA, OpenAIRE, RDA Europe 4.0, NI4OS project (National Initiatives for Open Science), SCOAP3 (Sponsoring Consortium for Open Access Publishing in Particle Physics), RIPE NCC (Réseaux IP Européens Network Coordination Center), ICOLC (International Coalition of Library Consortia), EGI Foundation, GÉANT, EuroHPC and G7 Open Science Working Group.

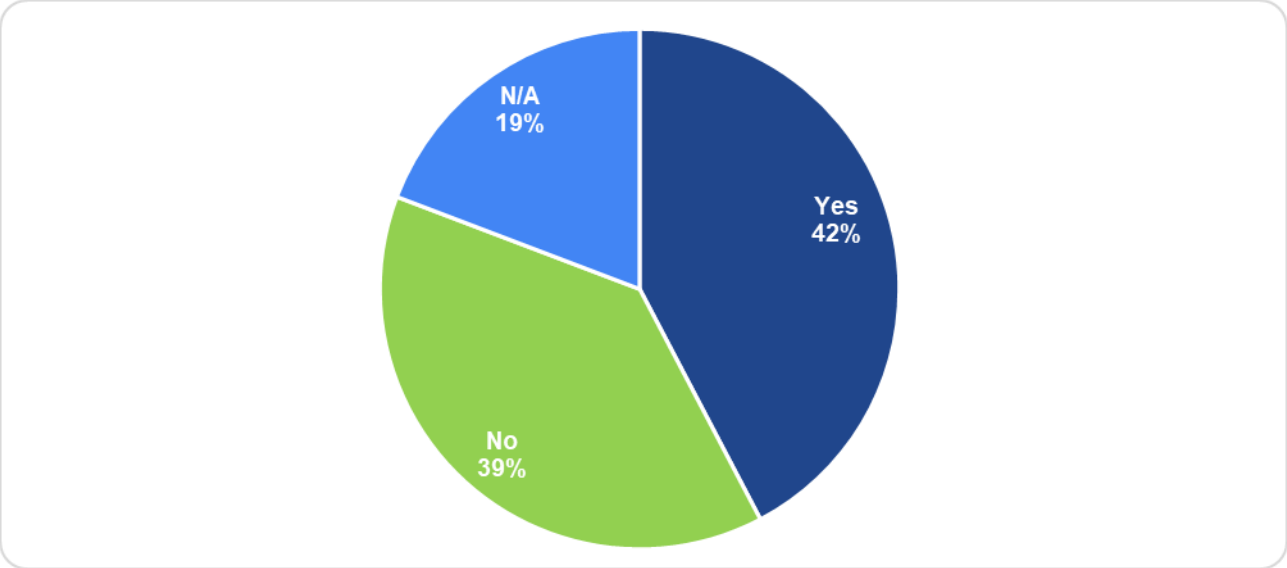
There is a clear tendency to be strongly involved in European or international initiatives. This means that funding organisations acknowledge the importance of the latter for OS and staying at the forefront of best practices. It also indicates that Open Science has an underlying *Community* feature, which goes beyond national considerations.

Chart 9 Did your organisation sign any declaration/memorandum regarding any Open Science-related topic? (like DORA declaration)



The majority of respondents has not signed any declaration or memorandum regarding Open Science. Out of 11 organisations that have signed a declaration or memorandum, 6 mentioned that their organisation has signed the DORA Declaration. Among other declarations, we also noted the Berlin Declaration, the EOSC Declaration, the Hong Kong Principles, the OA2020 and Plan S.

Chart 10 Do you take part in any ongoing external initiatives promoting Open Science in your country/region?



In total, 42% of funding organisations participate in ongoing external initiatives promoting Open Science in their country or region, which are very heterogeneous. The situation is rather heterogeneous. Funding organisations are open to participating in various networks (or even coordinate them) and projects. Some also mention active participation in international activities. Specific answers can be found in Table 11 of the Annex.

Part 5: Correlation between OS features

Table 4 Overview table

Funding Organisation	Do you have an OS Policy in the organisation?	Policy applies to all programmes	Recommendations on routes for publications in OA	Embargo for Publications Allowed	DMP obligatory	Data Sharing Obligatory	Embargo for Data allowed	OA Fees can be covered	Upper limit on OA Fees	Data Sharing Fees can be covered	Upper limit on data sharing	OA/ORD Officer @ the organisation	Member of international network (Science Europe, FairIsFair, OpenAIRE, etc.)	Signatory of DORA Declaration
AEI	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes
AKA	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	No	Yes	Yes	Yes
ANR	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes	Yes
F.R.S.-FNRS	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No	Yes	Yes	Yes	No
FCT	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	No
FNR	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
FRQNT	Yes	Yes	No	Yes	No	No	Yes	Yes	No	Yes	No	Yes	No	Yes
FWF	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
FWO	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes	No
GSRT	Yes	No	No	No	No	No	Yes	Yes	No	Yes	No	No	No	No
IRC*	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes
LMT	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No	Yes	Yes	No
MOST	Yes	Yes	No	No	No	No	Yes	Yes	No	Yes	No	No	No	No

NCN	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SNSF	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes
TA CR	Yes	No	Yes	Yes	Yes	No	Yes	Yes	No	Yes	No	Yes	No	No
TÜBİTAK	Yes	No	Yes	Yes	Yes	No	Yes	No	No	No	No	Yes	Yes	No
UKRI	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes
VR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No
BNSF	No	No	No	No	No	No	No	No	No	Yes	No	No	No	No
ETAg	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes
FFG	No	Yes	No	No	No	No	Yes	Yes	No	Yes	No	No	No	No
ISERD	No	No	No	Yes	No	No	Yes	No	Yes	No	Yes	No	No	No
MUR	No	No	No	Yes	No	No	Yes	No	Yes	No	Yes	No	Yes	No
SAS	No	No	No	Yes	No	No	Yes	Yes	No	Yes	No	No	No	No
UEFISCDI	No	No	No	No	No	No	No	Yes	No	No	Yes	Yes	Yes	No
VIAA	No	No	No	Yes	No	No	Yes	Yes	No	No	Yes	No	No	No
Yes	**19**	**17**	**15**	**18**	**15**	**12**	**21**	**22**	**6**	**19**	**8**	**16**	**18**	**11**
No	**8**	**10**	**12**	**9**	**12**	**15**	**6**	**5**	**21**	**8**	**19**	**11**	**9**	**16**

In this section, we analyse the correlations between a number of aspects of OS policies that admit a binary description. For each such aspect, we attribute a binary variable (0 or 1) and we compute the Pearson correlation (Pearson, 1895) between all the variables[2]. The latter is defined as the normalised covariance of two variables. For a discrete sample of two variables x and y, it can be computed as

$$\frac{\sum_{i=1}^{n} (x_i - x_0) \sum_{i=1}^{n} (y_i - y_0)}{\sqrt{\sum_{i=1}^{n} (x_i - x_0)^2} \sqrt{\sum_{i=1}^{n} (y_i - y_0)^2}},$$

where x_0 and y_0 are the means of x and y respectively and n is the number of data points. The Pearson correlation ranges from -1 to 1. The values -1 and 1 indicate a linear relation between the variables and the sign translates the way in which the variables vary in this relationship. For instance, if the correlation is 1, then x increases as y does. In what follows, the sign will be described as *positive* or *negative* correlation. On the other hand, a zero correlation translates to the absence of linear dependence between the variables.

Given the qualitative nature of the analysis, we assume that a correlation exists if the absolute value of the Pearson correlation is strictly bigger that 0,5. It is worth stressing that the Pearson correlation is only used as a way to detect correlations whose plausibility is confirmed through a qualitative analysis. Spurious or nonsensical relationships will not be discussed.

Open Science Policy

Let us first consider the existence of an OS policy. It is positively correlated with the application of the policy in all funding programmes as well as with the formulation of recommendation for routes (for OA publications) and the obligation of submission of a DMP. We interpret this as a *definition* of an OS Policy. Namely, the latter consists in a *set of recommendations or obligations for OA publications and for data management that apply to all programmes of a funding organisation*. On the other hand, OS policy is uncorrelated from embargo restrictions on publications and data sharing. In other words, there is no apparent dependency between the existence of an OS policy and the regulations on how embargos are handled. This means that embargos are, to date, not considered homogeneously across funding organisations. Consequently, this aspect is not mature enough at the policy level and could benefit from high-level exchanges between funding organisations.

Financial Support

In CHIST-ERA, we view an OS policy as an opportunity for researchers to increase the impact and the value of their works and to benefit from financial support in order to facilitate the process of open sharing of scientific results. If one considers the existence of national financial support for OA publications and sharing of ORD, it is easy to show that those two aspects are negatively correlated with the existence of upper limits on such funding opportunities. In other words, whenever such fees are covered, there are usually no upper limits. Grant beneficiaries have therefore the full freedom in choosing their publication venues independently of any financial considerations. This could be explained by the fact that the OA and ORD *market* is rather well regulated and that offers of service providers are reasonably aligned. It would be interesting to analyse the landscape of service providers in order to confirm this assumption.

When we consider the tolerance of embargos for publications and data sharing, we find no correlation[3] at all with the corresponding financial support. This is quite surprising and shows, once again, that embargos are still tolerated. This is further evidence and support for the direction in which the OS landscape should further mature.

[2] A more thorough statistical analysis will be performed at a later stage.

[3] The Pearson correlation here is almost 0!

Data Sharing

Consider the obligation of open data sharing. It is positively correlated to the obligation of providing a DMP, which shows that both aspects are intimately related in the process of developing an OS policy. If we now consider, additionally, the recommendation on routes for OA publications, we also find a positive correlation. Even if those aspects are not qualitatively related in the sense that OA and ORD developments can be independent from one another, this shows a certain level of maturity in the OS landscape in the form of "all or none".

Summary

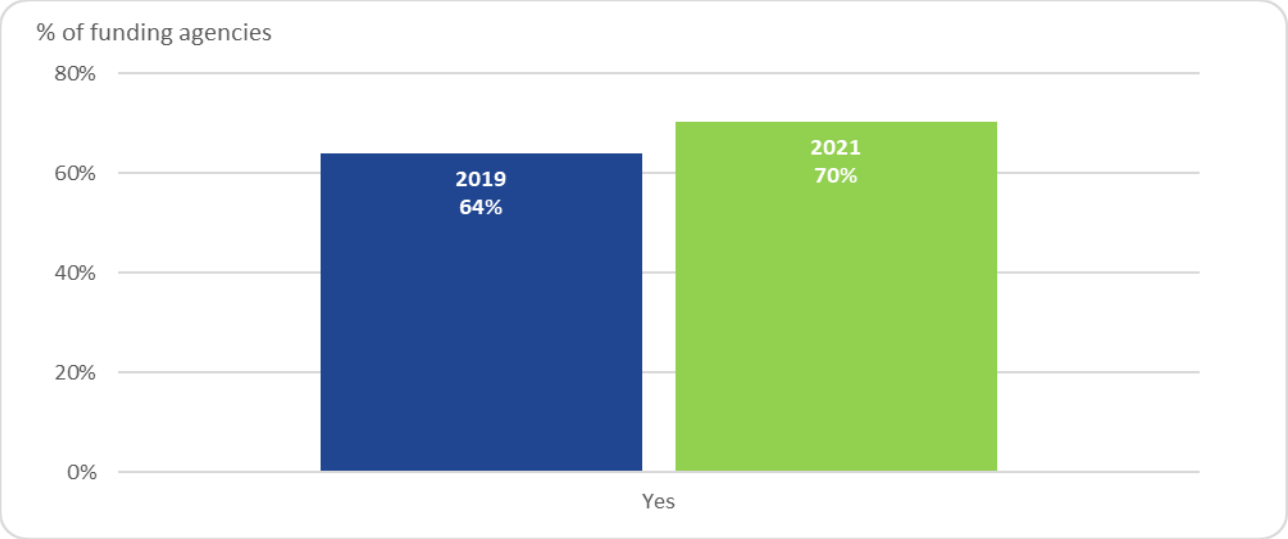
In short, the analysis of correlations between all binary variables of the OS analysis shows that the OS landscape is rather mature in the sense that the development of an OS policy usually considers a cluster of different aspects in order to define the content of the policy. This leads to a natural circumstantial definition of an OS policy. On the other hand, the analysis also shows a number of directions where the landscape should further mature through new policy developments, especially at the level embargos for OA publications and ORD sharing.

Chapter 2: Evolution 2019 – 2021

In this chapter, we exploit the multiyear data collected between 2019 and 2021 in order to estimate how the Open Science landscape evolved in recent years and predict possible future evolutions. The number of respondents in each year fluctuated around 25. The list of funding organisations participating in each year is given in Table 3.1. in Annex 3.

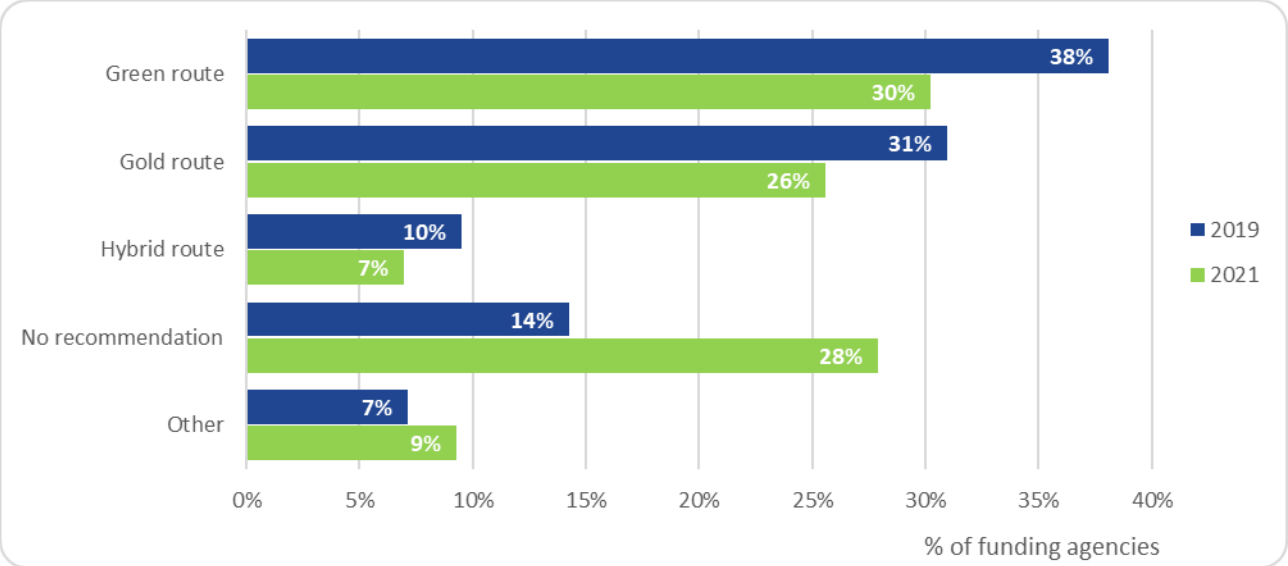
Part 1: Funder OS Policy & Support for Researchers

Chart 11 Do you have an Open Access policy (meaning that the researchers have to make their publications openly available)?



The number of funding organisations that have an Open Access policy has slightly increased in 2021. Given the short timescale, this is not negligible and the growth trend is clearly visible.

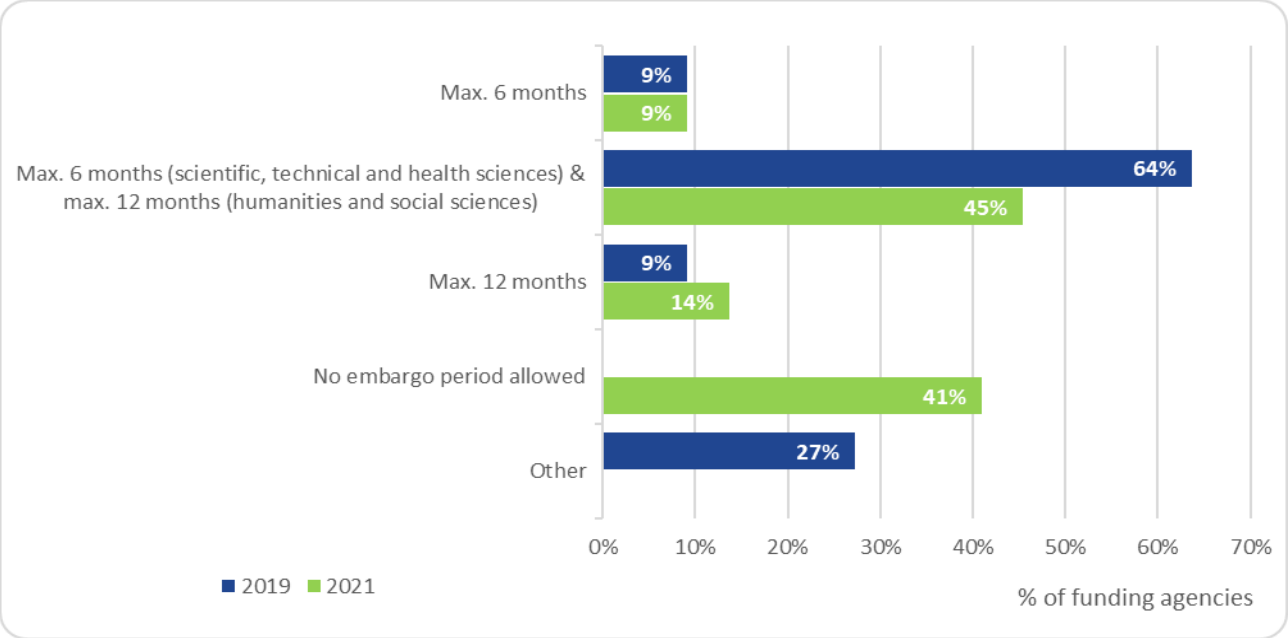
Chart 12 Recommendations on how publications should be available



Funding organisations that make recommendations to their recipients regarding the availability of publications mostly recommend the green and the gold routes. In 2021, the number of funding organisations that do not make any recommendations increased. The hybrid route is not popular and is often explicitly excluded.

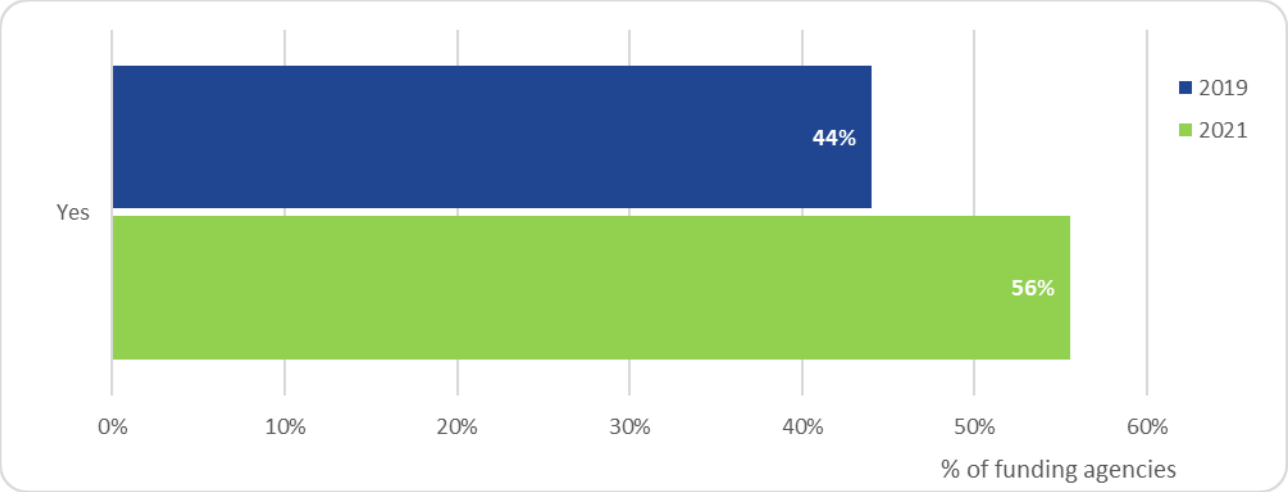
Due to the effort to ensure consistency between the data points over the years in order to evaluate the evolution of the landscape, we did not include recent developments such as the diamond route or other publishing platforms.

Chart 13 Embargo periods



As for embargos, the most popular option is to allow a maximum of six months (scientific, technical and health sciences) or 12 months (humanities and social sciences). An increasing number of funding organisations do not allow any embargo period at all, which is likely to be related to participation in Plan S. The general trend is to reduce the embargo to a minimum. Organisations without an OS policy are more likely to allow the embargo than those with a clear OS Policy.

Chart 14 DMP



Between 2019 and 2021, the obligation to develop a DMP increased by 21%. This is a significant increase compared to 2019, when a large number of scientists did not have to produce a DMP and, subsequently, to manage and to share data. This indicates an increasing emphasis on the importance of data management.

Nevertheless, as one can see from chart 2.5, the obligation of researchers to deposit their data in a repository increased by 8% only.

Chart 15 Data repository obligations

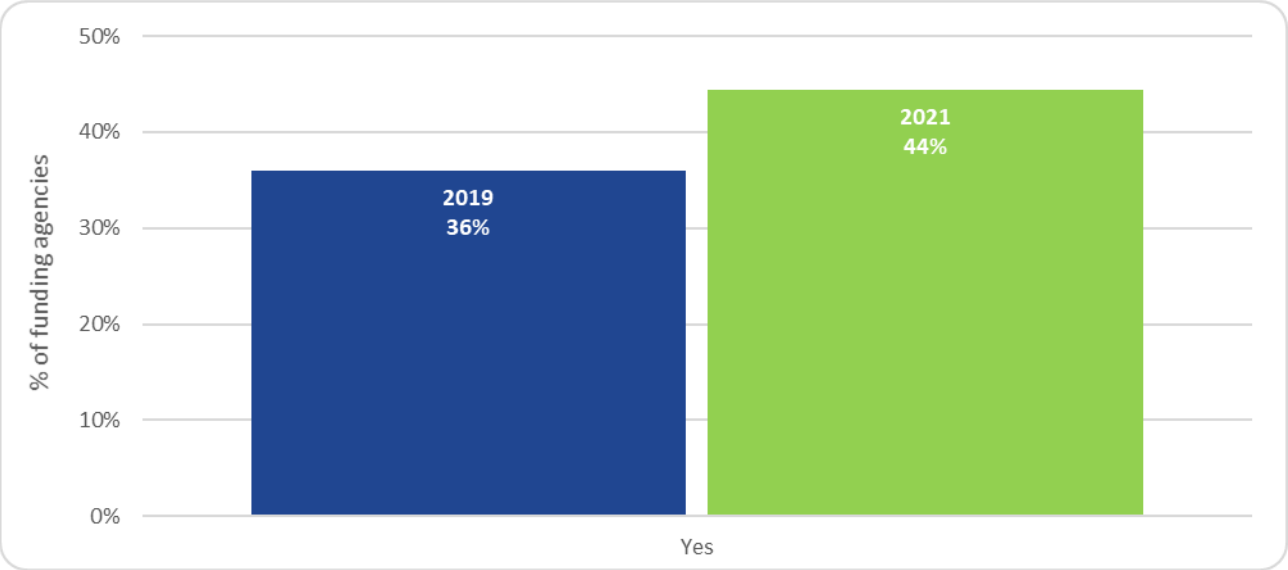
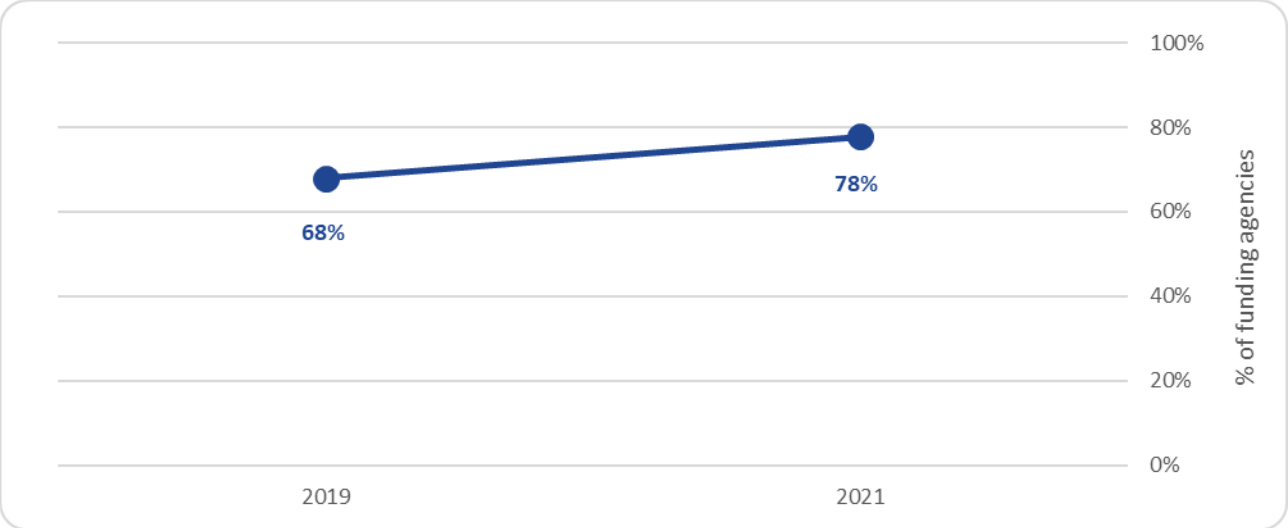


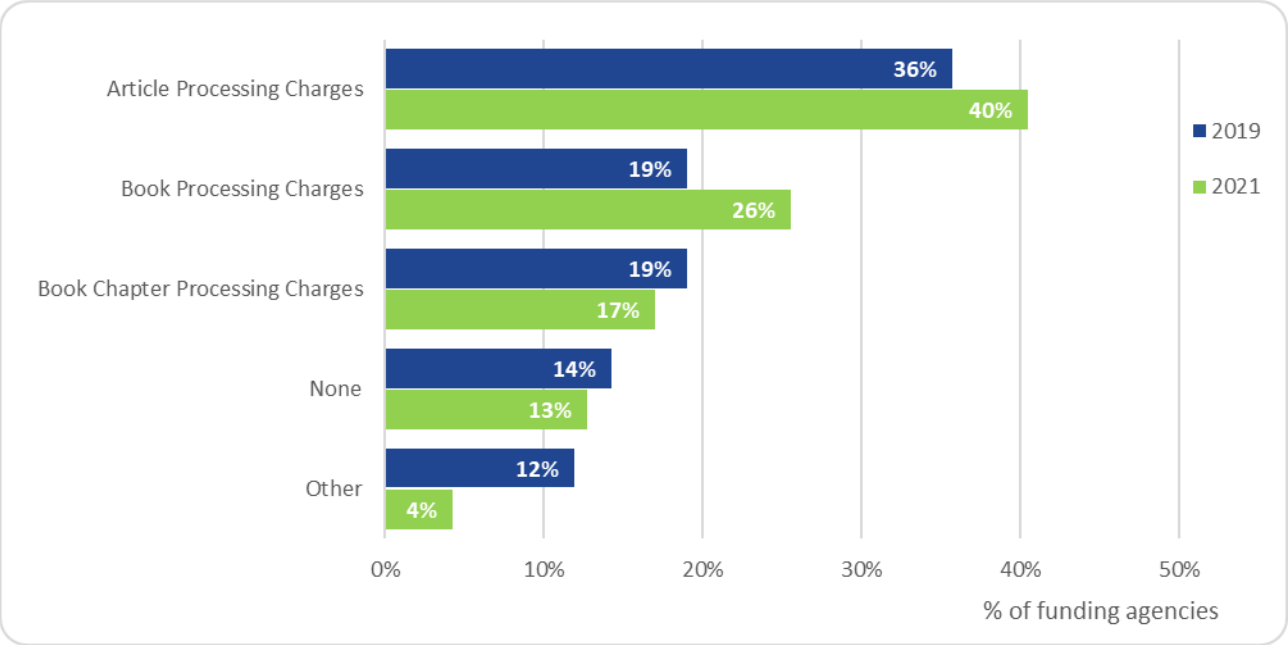
Chart 16 Embargo on data allowed



An increasing number of funding organisations allow embargo on research data, which means that even though researchers do have to share their research data openly on a data repository, 78% of the organisations still allow embargo periods.

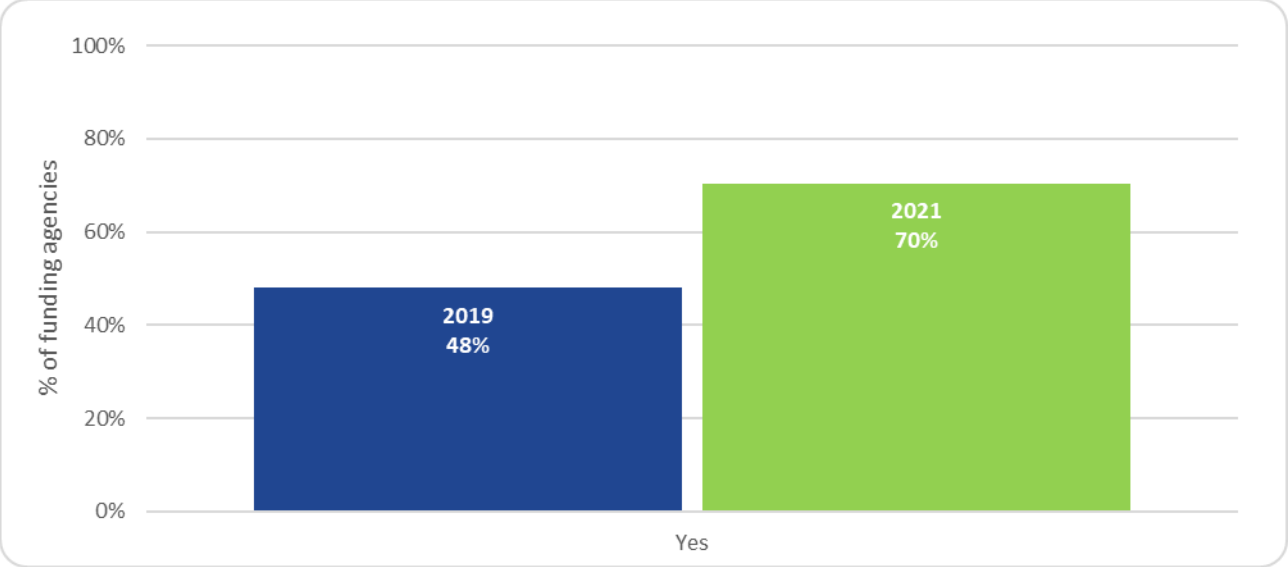
Part 2: Open Access Fees

Chart 17 Open Access fees supported



In terms of Open Access fees, organisations most often cover Article Processing Charges (slightly increasing trends) and Book Processing Charges. The number of "Other" and "None" responses is slightly decreasing, the distribution of other responses remains at approximately the same level.

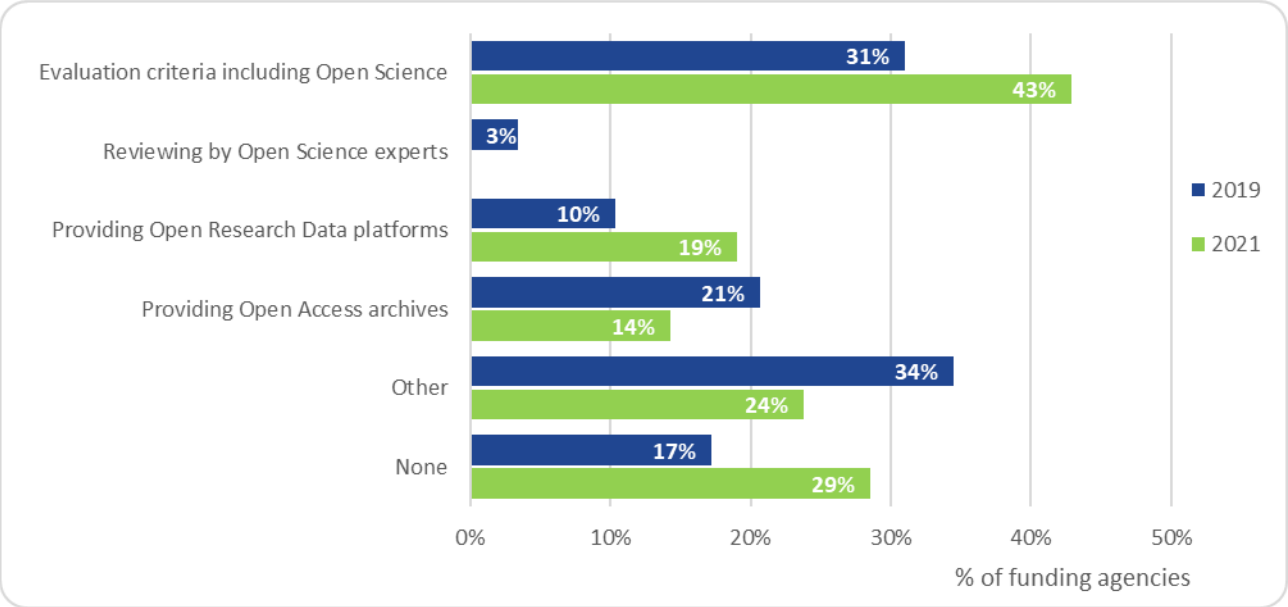
Chart 18 Data Sharing fees can be covered



The number of funding organisations that can financially support open sharing of research data (on data repositories) significantly increased to 70% in 2021. Most funding organisations do not set any upper limit.

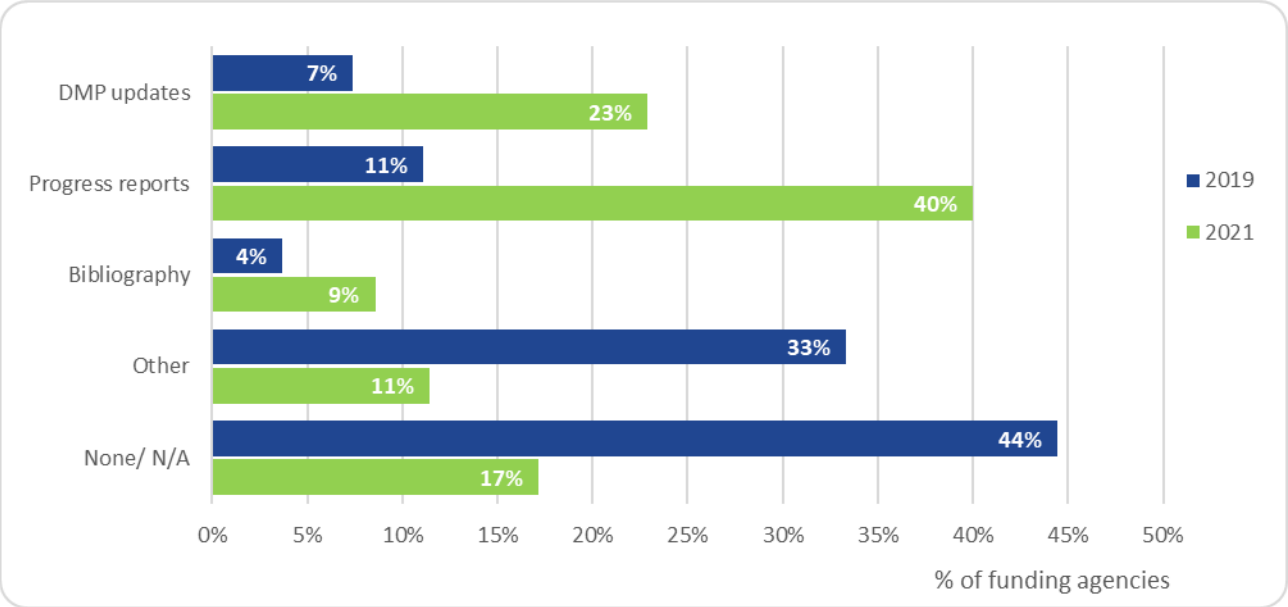
Part 3: Non-monetary tools to promote OS

Chart 19 Tools to support Open Science



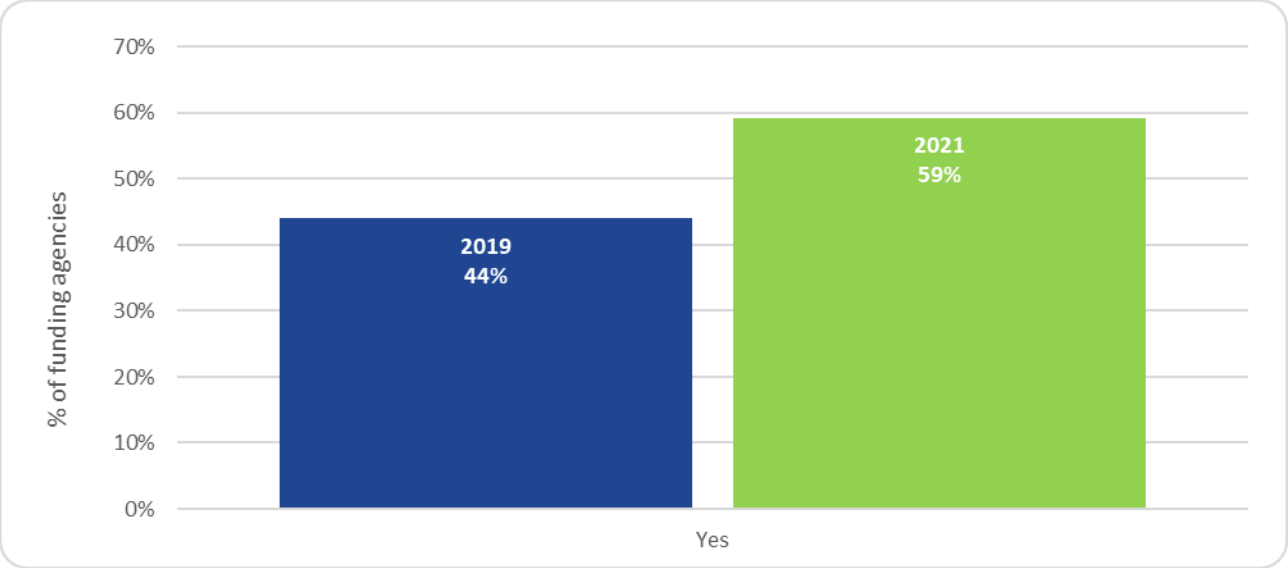
The tools to support Open Science are diverse. The use of OS within the evaluation criteria is quite widespread among the funding organisations. The fraction of organisations without any such measures or tools is surprisingly increasing. On the other hand, despite the negligible figures, resorting to OS experts in the evaluation process has taken off, which may signal a trend. It would be interesting to see if the latter is confirmed in the next years.

Chart 20 Monitoring tools



Progress reports and DMP updates became the most popular options to monitor the applications of Open Science practices. The number of funding organisations that do not monitor progress in the OS has strongly decreased. The bibliography is used only marginally for monitoring.

Chart 21 Is there an Open Access and/or open Research Data officer in your funding organisation?



The number of funding organisations with Open Access and / or Open Research Data officers is slightly growing. In other words, there is an increasing awareness of the importance of OS, such that it is being more and more anchored or institutionalised in funding organisations

References

ANR. “HAL Archive.” https://hal-anr.archives-ouvertes.fr/.

CHIST-ERA. “Call 2019 Announcement.” 2019, https://www.chistera.eu/sites/www.chistera.eu/files/CHIST-ERA%20Call%202019%20-%20Announcement.pdf.

CHIST-ERA. “CHIST-ERA Open Science policy.” 2021, https://www.chistera.eu/open-science-policy.

CHIST-ERA. “CHIST-ERA Open Science Policy Statement.” 2020, https://www.chistera.eu/chist-era-open-science-policy-statement.

cOAlitionS. 2018, https://www.coalition-s.org/about/.

CORD. *Concordat on Open Research Data*. 28 July 2016, https://www.ukri.org/wp-content/uploads/2020/10/UKRI-020920-ConcordatonOpenResearchData.pdf.

European Commission. “Funding & Tenders.” https://ec.europa.eu/research/participants/docs/h2020-funding-guide/cross-cutting-issues/open-access-data-management/data-management_en.htm.

FWF. https://www.fwf.ac.at/en/research-funding/fwf-programmes/stand-alone-publications.

FWF. 2022, https://www.fwf.ac.at/fileadmin/files/Dokumente/Antragstellung/Referierte_Publikationen/pur_application-guidelines.pdf.

OpenAIRE. “OpenAIRE Funder Monitoring Dashboard.” https://www.openaire.eu/item/openaire-funder-monitoring-dashboard.

OPIDoR. https://dmp.opidor.fr/.

Pearson, K. “Notes on regression and inheritance in the case of two parents.” *Proceedings of the Royal Society of London, 58*, 1895, pp. 240–242, https://books.google.com/books?id=60aL0zlT-90C&pg=PA240.

SNSF. “SNSF Open Access Check.” http://www.snsf-oa-check.ch/.

Annexes

Annex 1: Survey form

3.1. Survey form – template OPEN SCIENCE POLICIES SURVEY 2021 template.docx

Annex 2: Curated raw data - links

Data on Zenodo: https://zenodo.org/deposit/6597451

Annex 3: Tables

Table 5 List of participating funding organisations in 2019 and 2021

Year of Agency Participation		Country
2021	**2019**	
AEI	x	Spain
AKA	AKA	Finland
ANR	ANR	France
BNSF	BNSF	Bulgaria
ETAg	ETAg	Estonia
F.R.S.-FNRS	F.R.S. – FNRS	Belgium
FCT	FCT	Portugal
FFG	FFG	Austria
FNR	FNR	Luxembourg
FRQNT	FRQNT	Québec
FWF	FWF	Austria
FWO	FWO	Belgium
GSRT	GSRT	Greece
ISERD**	InnovationAuth	Israel
IRC*	IRC	Ireland
LMT	LMT	Lithuania
MOST	x	Taiwan
MIUR	MIUR	Italy
NCN	NCN	Poland
SAS	SAS	Slovakia
SNSF	SNSF	Switzerland
TA CR	TACR	Czech Republic
TÜBİTAK	TÜBITAK	Turkey
UEFISCDI	UEFISCDI	Romania
UKRI	UKRI	United Kingdom
VIAA	x	Latvia
VR	VR	Sweden
27	24	

**IRC has not responded in 2021 survey, information is taken out of IRC website*

*** InnovationAuth changed its name to ISERD*

Table 6 Recommendation on how publications should be accessible per funding organisations

Country	Funding Organisation	Green route	Gold route	Hybrid route	Other	No recommendation
	Total	**13**	**11**	**3**	**3**	**13**
Austria	**FWF**	x	x	x		
Austria	**FFG**					x
Belgium	**FWO**					x
Belgium	**F.R.S.-FNRS**	x				
Bulgaria	**BNSF**					x
Czech Republic	**TA CR**	x	x			
Estonia	**ETAg**	x	x		x	
Finland	**AKA**	x	x			
France	**ANR**	x				
Greece	**GSRT**					x
Ireland	**IRE**	x	x			
Israel	**ISERD**					x
Italy	**MIUR**					x
Latvia	**VIAA**					x
Lithuania	**LMT**		x			
Luxembourg	**FNR**	x	x		x	
Poland	**NCN**	x	x	x	x	
Portugal	**FCT**	x				
Québec	**FRQNT**					x
Romania	**UEFISCDI**					x
Slovakia	**SAS**					x
Spain	**AEI**					x
Sweden	**VR**	x	x	x		x
Switzerland	**SNSF**		x			
Taiwan	**MOST**					x
Turkey	**TÜBİTAK**	x				
United Kingdom	**UKRI**	x	x			

Table 7 Links to Open Access policies

Country	Funding Organisation	OA Policy	If yes, please provide a link	OS Policy in all programmes
Austria	**FFG**	No		Yes
Austria	**FWF**	Yes	https://www.fwf.ac.at/en/research-funding/open-access-policy/open-access-to-peer-reviewed-publications	Yes
Belgium	**F.R.S.-FNRS**	Yes	https://www.frs-fnrs.be/docs/Reglement_OPEN_ACCESS_EN.pdf	Yes
Belgium	**FWO**	Yes	https://www.fwo.be/en/the-fwo/research-policy/open-access/	Yes
Bulgaria	**BNSF**	No		No
Czech Republic	**TA CR**	Yes	https://www.tacr.cz/en/open-access-in-the-kappa-programme/	No
Estonia	**ETAg**	No		No
Finland	**AKA**	Yes	https://www.aka.fi/en/research-funding/responsible-science/open-science/academy-policies-on-open-science/open-access-to-scientific-publications/	Yes
France	**ANR**	Yes	https://anr.fr/en/anrs-role-in-research/values-and-commitments/open-science/	Yes
Greece	**GSRT**	Yes	N/A	No
Ireland	**IRC***	Yes	https://research.ie/assets/uploads/2017/05/IRC_Open_Access_Policy_Final.pdf	Yes
Israel	**ISERD**	No		No
Italy	**MUR**	No	N/A	No
Latvia	**VIAA**	No		No
Lithuania	**LMT**	Yes	https://www.lmt.lt/data/public/uploads/2016/09/eng_-atvira-prieiga-_-galutinis.pdf	Yes
Luxembourg	**FNR**	Yes	https://storage.fnr.lu/index.php/s/bfSqYc8bLBAJrjz	Yes
Poland	**NCN**	Yes	https://www.ncn.gov.pl/sites/default/files/pliki/zarzadzenia-dyrektora/zarzadzenieDyr-38_2020_ang.pdf#page=2	Yes
Portugal	**FCT**	Yes	https://www.fct.pt/acessoaberto/index.phtml.en	Yes
Québec	**FRQNT**	Yes	https://frq.gouv.qc.ca/app/uploads/2021/05/politique-libre-acces_en_avril19.pdf	Yes
Romania	**UEFISCDI**	No		No
Slovakia	**SAS**	No		No
Spain	**AEI**	Yes	https://www.ciencia.gob.es/Estrategias-y-Planes/Planes-y-programas/PEICTI.html	Yes
Sweden	**VR**	Yes	https://www.vr.se/english/applying-for-funding/requirements-terms-and-conditions/publishing-open-access.html	Yes

Switzerland	**SNSF**	Yes	https://oa100.snf.ch/en/home-en/ (website) http://www.snf.ch/SiteCollectionDocuments/Reglement-ueber-OA-Publikationsfoerderung-E.pdf (Regulations)	Yes
Taiwan	**MOST**	Yes	https://wsts.most.gov.tw/STSWeb/Award/AwardMultiQuery.aspx	Yes
Turkey	**TÜBİTAK**	Yes	https://ulakbim.tubitak.gov.tr/sites/images/Ulakbim/tubitak_open_sciency_policy-eng.pdf	No
United Kingdom	**UKRI**	Yes	https://www.ukri.org/wp-content/uploads/2020/11/UKRI-121120-Open-access-policy-FAQs.pdf%20 and https://www.ukri.org/about-us/policies-standards-and-data/good-research-resource-hub/open-research/	Yes

Table 8 Open Access policy per country and funding organisation

Country	Funding organisation	2019	2021
Austria	FFG	No	No
Austria	FWF	Yes	Yes
Belgium	F.R.S.-FNRS	Yes	Yes
Belgium	FWO	Yes	Yes
Bulgaria	BNSF	No	No
Czech Republic	TA CR	No	Yes
Estonia	ETAg	Yes	No
Finland	AKA	Yes	Yes
France	ANR	Yes	Yes
Greece	GSRT	No	Yes
Ireland	IRC	Yes	Yes
Israel	ISERD	No	No
Italy	MIUR	No	No
Latvia	VIAA	-	No
Lithuania	LMT	Yes	Yes
Luxembourg	FNR	Yes	Yes
Poland	NCN	No	Yes
Portugal	FCT	Yes	Yes
Québec	FRQNT	Yes	Yes
Romania	UEFISCDI	No	No
Slovakia	SAS	No	No
Spain	AEI	-	Yes
Sweden	VR	Yes	Yes
Switzerland	SNSF	Yes	Yes
Taiwan	MOST	-	Yes
Turkey	TÜBİTAK	Yes	Yes
United Kingdom	UKRI	Yes	Yes

Table 9 Comparison of Guidelines on Open Access and Open Research Data per Country

Country	Funding Organisation	Open Access guidelines	Open Research Data guidelines
Austria	**FFG**	No	Yes
Austria	**FWF**	Yes	Yes
Belgium	**FWO**	No	No
Belgium	**F.R.S.-FNRS**	Yes	No
Bulgaria	**BNSF**	No	No
Czech Republic	**TACR**	No	No
Estonia	**ETAg**	Yes	Yes
Finland	**AKA**	Yes	Yes
France	**ANR**	Yes	Yes
Greece	**GSRT**	No	No
Ireland	**IRC**	Yes	Yes
Israel	**ISERD**	No	No
Italy	**MIUR**	No	No
Latvia	**VIAA**	No	No
Lithuania	**LMT**	Yes	Yes
Luxembourg	**FNR**	Yes	Yes
Poland	**NCN**	Yes	Yes
Portugal	**FCT**	Yes	Yes
Québec	**FRQNT**	Yes	No
Romania	**UEFISCDI**	No	No
Slovakia	**SAS**	**No**	**No**
Spain	**AEI**	Yes	Yes
Sweden	**VR**	Yes	Yes
Switzerland	**SNSF**	Yes	Yes
Taiwan	**MOST**	Yes	No
Turkey	**TÜBİTAK**	Yes	Yes
United Kingdom	**UKRI**	Yes	Yes

Table 10 Open Access fees per funding organisations

Country	Funding Organisation	Article Processing Charges	Book Processing Charges	Book Chapter Processing Charges	None	Other	Is there an upper limit?
	Total	18	12	8	6	2	No
Austria	FWF	x	x	x			Yes
Austria	FFG	x	x	x			No
Belgium	FWO	x	x				Yes
Belgium	F.R.S.-FNRS	x					No
Bulgaria	BNSF						No
Czech Republic	TA CR	x					No
Estonia	ETAg	x	x				
Finland	AKA				x		No
France	ANR	x					No
Greece	GSRT	x	x	x			
Israel	ISERD				x		
Italy	MUR				x		No
Latvia	VIAA	x	x				No
Lithuania	LMT	x	x				Yes
Luxembourg	FNR	x					No
Poland	NCN	x	x	x		x	Yes
Portugal	FCT					x	
Québec	FRQNT				x		No
Romania	UEFISCDI	x	x	x			
Slovakia	SAS	x	x	x			No
Spain	AEI	x	x	x			
Sweden	VR	x					No
Switzerland	SNSF	x	x	x			
Taiwan	MOST				x		No
Turkey	TÜBİTAK				x		No
United Kingdom	UKRI	x					Yes

Legend: Green colour – members of Coalition S

Table 11 Do you take part in any ongoing external initiatives promoting Open Science in your country/region?

Country	Funding Organisation	Do you take part in any ongoing external initiatives promoting Open Science in your country/region?
Austria	FFG	• Founding member of Open Science Network Austria (OANA, https://oana.at/) • Board member of The Austrian Social Science Data Archive (AUSSDA, https://aussda.at/) • Member of the national Mirror Group to the ERAC sub-working-group on Open Science and Innovation • Took active part in the Mutual Learning Exercise on Open Science - Altmetrics and Rewards (2017-2018)
Austria	FWF	• Austrian Academic Library Consortium (KEMÖ) (together with the Austrian Academic Library consortium, the FWF negotiates Open Access agreements) • Open Science Network Austria (OANA) • AT2OA – Austrian Transition to Open Access • FAIR Data Austria • National EOSC Café
Finland	AKA	Open Science national coordination https://avointiede.fi/en
France	ANR	We work with the French Committee for Open Science and we are part of different working groups within this Committee: Publication College and Research Data College for instance
Luxembourg	FNR	There was an openAIRE conference in 2019, and we are open to other initiatives as well.
Poland	NCN	NCN coordinates a national network of EOSC Association members based in Poland
Romania	UEFISCDI	The information below is collected in the activities we carry out in the form of a national Open Science hub (Open Science Knowledge Hub Romania), being national representatives in the networks openAIRE (openAIRE NOAD Romania) and RDA Europe 4.0 (RDA Node Romania), members Science Europe and partners of the NI4OS project (National Initiatives for Open Science) through which we support national "Open Science cloud" initiatives that can contribute to the development of EOSC (European Open Science Cloud). We are also mainly responsible for developing the strategic framework for Open Science in Romania within the project “Increasing the capacity of the RDI system to respond to global challenges. Strengthening the anticipatory capacity for evidence-based public policy making”– SIPOCA 592.
Switzerland	SNSF	Collaboration in the development of national Open Access and open research data strategies (lead by the Rectors Conference): https://www.swissuniversities.ch/fileadmin/swissuniversities/Dokumente/Hochschulpolitik/open_Access/open_Access_strategy_final_e.pdf https://www.swissuniversities.ch/fileadmin/swissuniversities/Dokumente/Hochschulpolitik/ORD/Swiss_National_ORD_Strategy_en.pdf
Turkey	TÜBİTAK	National Points of Reference on Scientific Information UNESCO Open Science National Expert EOSC Organizations

		DataCite Membership

List of Abbreviations

Abbreviation	Explanation / Meaning
AEI	State Research Agency
AKA	Academy of Finland
ANR	French National Research Agency
BNSF	Bulgarian National Science Fund
DMP	Data Management Plan
DORA	Declaration on Research Assessment
EEA	European Economic Area
ERA-NETs	European Research Area Net
ETAg	Estonian Research Council
F.R.S.-FNRS	Fund for Scientific Research-FNRS
FCT	Foundation for Science and Technology
FFG	Austrian Research Promotion Agency
FNR	Luxembourg National Research Fund
FRQNT	Quebec Research Funds
FWF	Austrian Science Fund
FWO	Research Foundation – Flanders
GSRT	General Secretariat for Research and Technology
FRQNT	Quebec Research Funds
FWF	Austrian Science Fund
FWO	Research Foundation – Flanders
GSRT	General Secretariat for Research and Technology
IRC	Irish Research Council
ISERD	Israel-Europe Directorate for Research&Innovation
LMT	Research Council of Lithuania
MIUR	Ministry of Education, University and Research
MOST	Ministry of Science and Technology
N/A	Not Applicable/Not Available
NCN	National Science Centre
OA	Open Access

OpenAIRE	European Open Science Infrastructure
OS	Open Science
PMC	PubMed Central
R&D	Research and Development
RDA	Research Data Alliance
SAS	Slovak Academy of Sciences
SNSF	Swiss National Science Foundation
TA CR	Technology Agency of the Czech Republic
TÜBİTAK	Scientific and Technological Research Council of Turkey
UEFISCDI	Executive Unit for the Financing of Higher Education, Research, Development and Innovation
UKRI	UK Research and Innovation
VIAA	State Education Development Agency
VR	Swedish Research Council