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Mutual Learning Exercise

Open Science: Altmetrics and Rewards

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Mutual Learning Exercise: Open Science — Altmetrics and Rewards

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Contact (H2020 PSF – Mutual Learning Exercise: Open Science — Altmetrics and Rewards)

Ana CORREIA, Coordinator of the MLE, Unit A4 - Ana.CORREIA@ec.europa.eu
René VON SCHOMBERG, Team Leader, Unit A.2 – Rene.VONSCHOMBERG@ec.europa.eu
Irmela BRACH, Senior Policy Officer, Unit B.2 - Irmela.BRACH@ec.europa.eu

Contact (H2020 PSF coordination team):

Román ARJONA, Chief Economist and Head of Unit A4 – Roman.ARJONA-GRACIA@ec.europa.eu
Stéphane VANKALCK, PSF Head of Sector, Unit A4 - Stephane.VANKALCK@ec.europa.eu
Diana SENCZYSZYN, PSF Team Leader, Unit A4 – Diana.SENCZYSZYN@ec.europa.eu

European Commission
B-1049 Brussels

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EUROPEAN COMMISSION

Mutual Learning Exercise

Open Science: Altmetrics and Rewards

Prepared by the independent experts:

Frank Miedema (Chair)

Katja Mayer (Rapporteur)

Kim Holmberg

Sabina Leonelli

2018 Directorate-General for Research and Innovation EN

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THE PSF MLE PANEL

Frank Miedema - Chair (The Netherlands)

Frank Miedema is Dean and Vice-President of the Executive Board of UMC Utrecht. He studied biochemistry at the University of Groningen, specialising in immunology, with a minor in the Philosophy of Science. He obtained a PhD from the University of Amsterdam at the Central Laboratory of the Blood Transfusion Service (CLB), now Sanquin. From 1983, he was a project leader there in the immunovirology of HIV/AIDS, as part of the Amsterdam Cohort Studies. In 1996, he was appointed full professor at the AMC/University of Amsterdam and became Director of Sanquin Research in 1998. In 2004, he became head of the Immunology Department at the University Medical Center Utrecht. From 2009 he is dean and vice chairman of the Executive Board at the University Medical Center Utrecht. He is one of the initiators of www.scienceintransition.nl/english. Science in Transition believes that the scientific incentive and reward system is in need of fundamental reform. Next to Science for Science (articles in 'high-impact' journals), the added value for society requires greater appreciation and societal stakeholders should be involved more integrally in the production of knowledge.

Katja Mayer - Rapporteur (Austria)

Katja Mayer trained as a sociologist and works at the intersection of science-technology-society. She studies the interactions of social scientific method and its publics. She is currently studying open practices in Computational Social Science and Big Data as a postdoc at the School of Governance, Technical University Munich. She also works as a senior scientist at the Centre for Social Innovation in Vienna, and is an associated researcher for the Responsible Research and Innovation in Academic Practice platform at the University of Vienna. Furthermore, she has been teaching sociology of knowledge and STS at the University of Vienna, Danube University, Krems, University of Art and Design Linz and the University of Luzern, among others and was a visiting fellow at the Carnegie Mellon University's School of Computer Science. She is an active member of the Open Knowledge Foundation's working group on Open Science and participates in the OANA (Open Access Network Austria) working group on defining a national strategy for the transition to Open Access publishing. During 2011-2013, she was scientific advisor to the president of the European Research Council (ERC).

Kim Holmberg - Expert (Finland)

Kim Holmberg is a senior researcher at the Research Unit for the Sociology of Education (RUSE) at the University of Turku, Finland. At RUSE, Dr Holmberg works on questions related to scholarly communication, altmetrics, bibliometrics, informetrics, Open Science and social media. Recently, he was the principal investigator of a project entitled 'Measuring the Societal Impact of Open Science', which was financed by the Finnish Ministry of Education and Culture's Open Science and Research Initiative (2015-2017). The project focused on investigating the meaning, validity and applicability of altmetrics. Holmberg is an honorary research fellow at the Statistical Cybermetrics Research Group at the University of Wolverhampton, UK, and holds the title of Docent in Informetrics at Åbo Akademi University, Finland. His academic background includes periods as a postdoc researcher at the University of Wolverhampton, UK, and at the VU University Amsterdam, the Netherlands. In 2015, he published a book about altmetrics, 'Altmetrics for Information Professionals – Past, Present and Future' (Chandos Publishing).

Sabina Leonelli - Expert (UK/Italy)

Sabina Leonelli is Professor of Philosophy and History of Science at the University of Exeter and Co-Director of the Exeter Centre for the Study of the Life Sciences, where she leads the data studies research strand. Her research focuses on the philosophy, history and sociology of data-intensive science, especially the research processes, scientific outputs and social embedding of Open Science and Open Data; scientific governance, ethics and research management in the age of artificial intelligence; and the role of non-human organisms in biological research and experimental practice. Her work has been supported by several funding bodies, including the European Research Council, the Australian Research Council, the British Academy and the UK Economic and Social Research Council. She has published widely on philosophy, biology and social studies of science, including a recent book called 'Data-Centric Biology: a Philosophical Study' with Chicago University Press and the report 'Biomedical Knowledge Production in the Age of Big Data' for the Swiss Science and Innovation Council. She is a member of the European Commission's Open Science Policy Platform on which she chaired the working group on Open Access Publishing, and serves in the boards of multiple learned societies.

EXECUTIVE SUMMARY

At its meeting in May 2016, the Competitiveness Council adopted conclusions on 'The transition towards an Open Science system' where it acknowledges that "Open Science has the potential to increase the quality, impact and benefits of science and to accelerate advancement of knowledge by making it more reliable, more efficient and accurate, better understandable by society and responsive to societal challenges, and has the potential to enable growth and innovation through reuse of scientific results by all stakeholders at all levels of society, and ultimately contribute to growth and competitiveness of Europe".

Open Science is a global movement to improve accessibility to and reusability of research practices and outputs. In its broadest definition, it encompasses Open Access to publications, Open Research Data and Methods, Open Source, Open Educational Resources, Open Evaluation, and Citizen Science.

The implementation of Open Science provides an excellent opportunity to renegotiate the social roles and responsibilities of publicly funded research and to rethink the science system as a whole. The Policy Support Facility – a Horizon 2020 instrument – gives Member States and Associated Countries the opportunity to request and take part in a mutual learning exercise (MLE) to address specific science, technology and innovation (STI) policy challenges. The transition to Open Science represents such a policy challenge which is best tackled in close cooperation with all stakeholders and on an international scale.

In July 2016, the call for interest brought together **13 countries: Armenia, Austria, Belgium, Bulgaria, Croatia, France, Latvia, Lithuania, Moldova, Portugal, Slovenia, Sweden and Switzerland.** The scope of this first MLE on Open Science was narrowed down to address three topics, all of which are key elements of the European Open Science Agenda:

1. The potential of altmetrics – alternative (i.e. non-traditional) metrics that go beyond citations of articles – to foster Open Science

2. Incentives and rewards for researchers to engage in Open Science activities

3. Guidelines for developing and implementing national policies for Open Science.

The MLE facilitates communication and reciprocal learning across countries, and between countries, EU policymakers and Open Science experts. Starting from the fact that European countries vary considerably in their adoption of Open Science and that there is no common baseline for how to implement Open Science on a national level, the exercise embraced a hands-on 'learning by doing' approach supported by external expertise. By turning diversity into a virtue, countries learn from concrete experiences, exchange know-how and foster understanding of the implications of Open Science strategies. This report builds on this exchange of experiences, both positive and negative, and

provides an overview of various models of Open Science implementation across Europe, which include different stakeholders and research communities.

This report:

1. Reflects the mutual and peer-supported learning to support countries in designing, implementing and/or evaluating different approaches and instruments for the advancement of Open Science

2. Addresses first and foremost policymakers, but also decision-makers in research management, research services and funding organisations

3. Identifies good practices, lists priorities and outlines potential courses of action.

MLE participants agreed that small fixes are not enough: implementing Open Science requires **systemic and comprehensive change in science governance and evaluation**. Crucial for a successful transition to Open Science will be strategic and paradigmatic shifts in the incentives and reward systems.

Altmetrics have the potential to foster such a paradigmatic shift in evaluating and rewarding research activities. They can reflect a wider view on what impact is and how it is created and can thus help to break away from traditional citation-based indicators and promote innovative multiple perspectives on measuring unconventional types of research output, such as data, methods, blogs, and public engagement.

However, the use of altmetrics also raises several substantive concerns. One is that it is not yet clear what kind of qualities such altmetrics indicate. In order to learn more about the meaning of altmetrics, experimentation should be encouraged and experiences should be exchanged across countries and research communities. Another concern is that providers of altmetrics data are themselves not fully open in terms of the methods and data they employ in aggregating the data. Hence, results are hardly replicable, and their use in decision making is neither standardised nor transparent.

Alternative and conventional metrics alike need to be made more open: making data sources and their documentation accessible, making methods available, and introducing guidelines for their usage. Moreover, all types of metrics require a broad discussion on "what matters", what kind of research qualities and societal impacts or benefits we would like to trace and measure, keeping in mind that the performance and impact of Open Science should be evaluated against a clear set of goals and missions. What are the observable benefits of using altmetrics for governments, research organisations and funders, and researchers? How could they be used as incentives for openness and tools for visibility? A shift to use of multiple indicators for research assessment for openness involves decision-making on the basis of more complex information, and requires a break from existing assessment systems for many countries.

Furthermore, this entails planning periods of elaborate testing and training of assessors, which should be organised on supra-national levels. MLE participants welcome the recommendations for next-generation metrics for Open Science in the final report of the Expert Group on Altmetrics and endorse the coming activities of a European Forum for Next Generation Metrics.

Discussions during the MLE revealed that only a few types of Open Science **incentives and rewards** are currently being implemented in participating countries, the Liège Model and its mandatory linkage of internal assessment to research output stored in the institutional repository being the most prominent. Discussions during the MLE exposed the necessity to develop incentives for different stakeholders, the scope of incentives for researchers, research organisations and funders and, last but not least, for national governments and policymakers. It is not possible for researchers to adopt Open Science practices without a broad institutional shift in support and evaluation structures for research. Incentives for researchers need to include radical shifts in hiring and promotion procedures, a very good blueprint for future approaches is the Open Science Career Assessment Matrix (OSCAM) providing details of potential types of acknowledgements of researchers' often invisible work and other types of research outputs. Given the highly international nature of research networks, international coordination is crucial to the effective implementation of comparable measures. At the same time, each country, research funder and research-performing organisation needs to review the extent to which specific incentives will work in its specific context, and adapt the requirements discussed in this report accordingly. MLE participants strongly advocate the further development of EU strategies and policies fostering systemic change in the scientific reward system and support the implementation of pilot programmes and new instruments for human resources practices.

Furthermore, MLE discussions recurrently came to the following conclusions:

- **The implementation of Open Science needs to be part of the bigger picture.** We need to discuss the roles and functions of science in society right now, setting an agenda and missions for science and innovation based on openness.

- **National strategies for the implementation of Open Science are essential.** We need to better understand and align the links between Open Science policies and general STI policies. ERA should be the central platform for the development of national OS strategies.

- **We need Open Science champions and role models** to foster the uptake of Open Science practices and to create a sustainable transition towards more openness.

- **Open Science is enhancing knowledge markets and improving innovation.** The synergies of scholarly commons and the commercial exploitation of research outputs require a systematic review and substantial evidence.

Inferring from the diversity of positions and national initiatives for Open Science, we can see how important it is to work with modular approaches based on close monitoring and analysis of national contexts and research cultures. This report gathers lessons learned to suggest **a roadmap and stages for the implementation of Open Science**:

1. Mapping key stakeholders and organising venues for discussion

2. Planning and developing an Open Science strategy through close consultation with stakeholders

3. Incentivising Open Science practices by changing systems of evaluation and reward

4. Promoting critical thinking around the implementation of Open Research Data

5. Supporting and participating in international initiatives to develop and maintain Open Science infrastructures

6. Implementing a strategy based on clear goals, starting from Open Access

7. Monitoring and documenting the transition.

The proposed roadmap needs to be discussed in detail by stakeholders in each country, with national governments considering their response and strategies vis-à-vis European Open Science policies.

Participants expressed considerable interest in several **follow-up activities** to this MLE:

- A dedicated MLE on open infrastructures (such as the European Open Science Cloud - EOSC) and Open Research Data policies to discuss the co-design of national use cases, cost estimations, governance models, change management and so forth.

- The establishment of an expert group/working group on 'Open Leadership' based on the outcomes of this MLE but also of the expert working groups on skills and rewards to better address the need of role models, pioneers, and pilot activities and scenarios.

- A review meeting after one year, to keep up the momentum and to communicate and reflect achievements, hindrances and progress made after a year.

Throughout the course of the MLE, participants highlighted the crucial role of the European Commission in guiding and coordinating the process of Open Science implementation. MLE participants call on the European Commission to continue its important role in fostering Open Science by:

- making Open Science provisions a key part of FP9;
- coordinating infrastructure provision, training and the development of common standards;
- strenghtening information exchange and knowledge transfer about Open Science across European organisations;
- devising innovation policies based on the development of scholarly commons and clear legal frameworks;
- promoting European Open Leadership.

1 INTRODUCTION

This is the final report of the Mutual Learning Exercise (MLE) on **Open Science: Altmetrics and Rewards** and was carried out from February 2017 to January 2018.

The MLE is one of three instruments available under the overarching Policy Support Facility (PSF), which was set up by the European Commission within Horizon 2020 (H2020). The aim of the PSF is to give EU Member States (and countries associated to H2020) practical support to design, implement and evaluate reforms that enhance the quality of their R&I investments, policies and systems.

1.1 Background

At its meeting in May 2016, the Competitiveness Council adopted conclusions on 'The transition towards an Open Science system' where it acknowledges that "Open Science has the potential to increase the quality, impact and benefits of science and to accelerate advancement of knowledge by making it more reliable, more efficient and accurate, better understandable by society and responsive to societal challenges, and has the potential to enable growth and innovation through reuse of scientific results by all stakeholders at all levels of society, and ultimately contribute to growth and competitiveness of Europe".

A call for interest was launched in July 2016 asking European Research Area Committee (ERAC) delegates who wished to participate in an MLE on **Open Science** to express their interest and to briefly describe the major challenge(s) they wished to address and their expectations.

The scope objectives/outcomes, time schedule, working approach/methodology, distribution of work, meetings, reports and deadlines were reflected in a draft 'modus operandi' which was presented and discussed in the MLE kick-off meeting in February 2017. The final version was produced shortly after the meeting and used to guide implementation of the MLE.

1.2 Participating countries

The MLE attracted the interest of 13 countries: Armenia, Austria, Belgium, Bulgaria, Croatia, France, Latvia, Lithuania, Moldova, Portugal, Slovenia, Sweden and Switzerland. Their experience and feedback is summarised in Section 4 of this report (see Figure 1).

Figure 1: Participating countries in MLE Open Science

2 METHODOLOGY

The MLE followed the standard methodology for conducting Mutual Learning Exercises in the context of the Horizon 2020 Policy Support Facility 'Mutual Learning Exercise - a new methodology' (Luukkonen, 2016). As a Member-State-driven and policy challenge-based activity, the MLE promotes mutual learning between the participating countries. Over the course of one year, participating countries get together to explore the best ways to tackle the challenges identified, acknowledging the need for change or optimisation in the design and/or implementation of policy instruments while wanting to learn from experiences in other countries. Each participating country is expected to gain tailored information and expertise from the process, and is also open to other participants to learn from their circumstances/experiences.

Thus, the project is based on open, frank and confidential knowledge exchange among the participating countries. All are expected to participate actively, in a forthright manner, and to collect and synthesise the necessary empirical evidence in a timely manner and provide friendly peer support for mutual learning. The specific knowledge interests around the policy challenges identified may vary to some extent between the participating Member States, but they are sufficiently close in order that the process can benefit all participants and that learning is mutual. This process is called peer-supported learning.

DISTRIBUTION OF WORK:

1. **Participating countries:** appointed as their participant a sufficiently high-level person with experience and knowledge of the policy challenge, providing resources – in terms of labour – to contribute, provide the data and information the process requires, allocating time to attend meetings and potential country visits, among others.

2. **Independent experts:** The MLE was supported by the chair (Frank Miedema), selected by the Commission, a rapporteur and expert (Katja Mayer), and two other experts (Sabina Leonelli and Kim Holmberg). These experts were in charge of providing background information and preparing thematic reports on the MLE topic. The rapporteur wrote the meeting minutes and summarised the MLE learning in the final report.

3. **Commission services:** The Directorate-General for Research and Innovation actively supported the work of this MLE. Unit A4 'Analysis and monitoring of national research policies' closely cooperated with Unit A6 'Data, Open Access and Foresight' and Unit B2 'Open Science and ERA Policy'. The contacts were Ana Correia (Unit A4), René Von Schomberg (Unit A6) and Irmela Brach (Unit B2).

4. **PSF contractor:** The PSF contractor was in charge of the operational and logistics tasks in relation to the organisation of meetings, country visits, quality control and overall development of the MLE. The

contractor prepared the publication and e-book and was in charge of uploading material to the PSF Knowledge Center.

This report builds on this exchange of experience, both positive and negative, and provides an overview of various models of Open Science implementation across Europe, which include different stakeholders and research communities.

Specifically, **the report builds on five sources of information:**

1. The findings of four thematic reports provided by experts Kim Holmberg and Sabina Leonelli, which highlighted the potential of altmetrics, the types of incentives and rewards to be considered and, in general, the key concerns and challenges to implementing Open Science. Parts of these reports have been reproduced in or adapted for this final report, and are marked accordingly. All four thematic reports can be downloaded at the Policy Support Facility website.[1.]

2. The thematic reports include reviews of relevant background literature and policy documents outlining current and past activities undertaken at the European level and within countries to support and incentivise Open Science. For further details, it is highly recommended to read all four thematic reports;

3. Presentations on specific national initiatives and European reports provided by invited speakers during MLE meetings and country visits to Finland, Croatia and Switzerland; all presentations can be downloaded on the MLE website mentioned above.

4. Discussions among MLE participants on how Open Science can and should be implemented and fostered. These took place during the previous MLE meetings during 2017, and are documented in notes from group rapporteurs, which have been gathered together by Katja Mayer.

5. Responses provided by MLE participants to a questionnaire sent out in June 2017 specifically to solicit specific examples and perspectives on the current state of affairs across the participating countries. The responses from the MLE participants were compiled by Kim Holmberg and Sabina Leonelli in summer 2017. These questions and full answers are partly reported in the appendices of the respective thematic reports.

[1] The MLE webpage in the PSF Knowledge Center: http://europa.eu/!bj48Xg

3 BACKGROUND TO OPEN SCIENCE

"What science becomes in any historical era depends on what we make of it" (Harding, 1991)

This chapter briefs readers on the current status of Open Science in Europe with regard to the MLE topics of alternative metrics, incentives and rewards, and the implementation of Open Science.

3.1 The status of Open Science in Europe – implementation and aspiration

We are currently witnessing fundamental changes in the modus operandi of science spanning the entire spectrum of research practices and interactions within society around the globe. Every day researchers are making use of online tools, are digitally producing, sharing and reusing data and educational materials, and are communicating via social media and mobile applications. The ways in which knowledge can be created and shared have multiplied.[2]

Open Science – based on the idea that scientific knowledge of all kinds should be openly shared as early as is practical in the discovery process – is closely linked to this socio-technical innovation. By demanding maximum transparency and shareability in knowledge production and transfer as well as the participation of (all) relevant stakeholders in the scientific process, the Open Science movement strives to increase:

- reproducibility and accountability
- reusability and innovation
- collaboration and societal participation respecting diversity, fairness and social responsibility.

These dimensions call for a broad and systemic shift in current practices of scholarly communication, especially in the reconfiguration of publishing and evaluation, with careful consideration of research cultures and societal needs. Such a fundamental paradigmatic change entails the acknowledgement of scientific quality being much more than what can be found in mere publications in journals and books. The focus shifts towards research in the making, other forms of output, such as data or workflows and methods, as well as various types of social engagement and innovation.

Therefore, Open Science encompasses access to publications, methods and research data, open forms of evaluation including peer review, metrics and hiring procedures, open educational resources, and citizen science (Figure 2).

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[2] The open sharing of ideas and data has a long tradition in many international research communities, e.g. astronomy, meteorology, demography. Open Science is building on a broad experience base and further developing it (see also European Commission 2018c, p.9).

Figure 2: Key Dimensions of Open Science

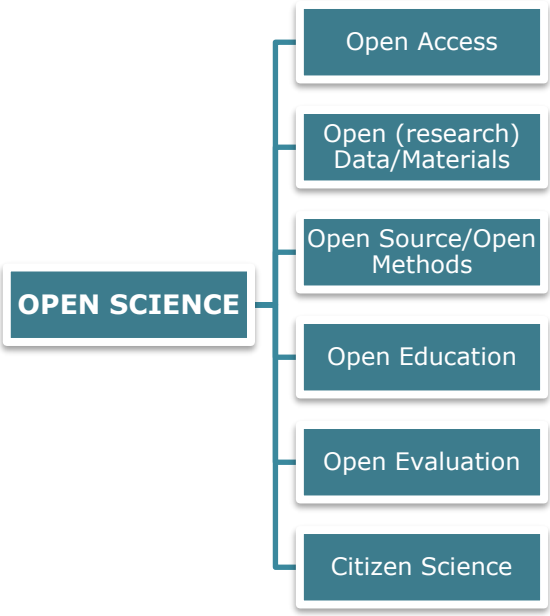

Table 1: Overview of Open Science dimensions

Dimensions	Description
Open Access	Open Access (OA) stands for unrestricted online access to research in general and is mostly associated with journal publications. However, it is applicable to all form of publications, data, reviews and educational resources. Generally, Open Access to research results enables faster and wider diffusion of knowledge digitally, and is thus one of the foundations of Open Science. Green Open Access stands for self-archiving of research output, e.g. at an institutional repository or on a personal website. This includes self-deposition of the author's accepted manuscript (after peer-review but prior to the publisher's copy editing and production) in any sustainable subject-related or institutional registered repository. Gold OA requires article processing charges (APC), e.g. by the publisher of a journal. Readers are not charged. Platinum OA grants free access for authors and readers, and is usually funded by subsidies or subscriptions from institutions.[3]
Open Research Data (ORD)	Open Data are online, unrestricted accessible data that can be used, reused and distributed provided that the data source is attributed. The FAIR principles for Open Research Data (ORD) therefore include:[4] • Findability • Accessibility • Interoperability • Reusability Data should be deposited in a way that it can be reused without restrictions.[5] An appropriate and registered repository must be selected; Deposited datasets have to be citable;[6] the definition of ORD includes also non-digital data, such as organic materials in biobanks. Opening data entails facing numerous ethical and legal issues. Therefore, ORD need a clear and decisive legal framework and open institutional policies to make an impact. 'As open as possible. As closed as necessary' is the name of the game.
Open Methods	The objective of Open Methods is to make clear accounts of the methods and sources used in research freely available via the internet. Scientific blogging and commenting culture are core practices in this regard. Open annotation, open bibliographies and reference management already point to the collaborative dimension of opening science in the making. Open Notebook science means making a research project available online as it is recorded, similar to

[3] For a detailed description of OA business models, please refer to: https://open-access.net/DE-EN/information-on-open-access/business-models/

[4] The FAIR principles: https://www.force11.org/group/fairgroup/fairprinciples

[5] DCC report on how to license research data: http://www.dcc.ac.uk/sites/default/files/documents/publications/reports/guides/How_To_License_Research_Data.pdf

[6] Recommendations for data citation: https://www.force11.org/datacitation

Dimensions	Description
	a lab notebook. Thus, such an online notebook could comprise project plans, protocols and other workflows, experimental set-ups, raw data, interpretations and memos. It holds a thorough documentation of sources and their accessibility, problem formulation and research design, and even acknowledgements of failure. Open Methods also include Open Source software and hardware.
Open Evaluation	In an Open Evaluation environment, there are written peer reviews, bibliographies, numerical ratings, usage statistics, social web information and citations in combination with other usage or participatory elements from social media. The difference is that the criteria, methods and databases for assessment are transparent and open and freely accessible. Reviewers' identities could be authenticated and reviews themselves gathered in a credit system (Ross-Hellauer, Deppe, & Schmidt, 2017). The altmetrics movement is currently developing a range of novel indicators to complement traditional measures by adding other research objects and output – such as research data – to assess impact. Several online Open Access platforms are already experimenting with new forms of post-publication peer review. Open Citation[7] initiatives have brought together publishers and scholars to build an openly accessible and transparent database of citation metadata to improve the reproducibility of bibliometric analysis.
Open Educational Resources	Open resources include freely distributable textbooks and teaching materials, such as filmed lectures, readings, problem sets, but also interactive user forums. Open courses could be collaboratively designed in cooperation with students. New digital education platforms support cooperation with open libraries, archives and memory institutions. Massive Open Online Courses (MOOCs) have been complementing traditional teaching since 2008 as a new form of interactive distance mass education.
Citizen Science	Citizen science – despite still being a nascent field – is already an expanding concept (Eitzel et al., 2017). The central function is the broadening of participation in science, including the social sciences and humanities. Supported by collaborative technologies, citizens can participate in the research design, data gathering, in the analytical process, and in dissemination and exploitation activities. Furthermore, citizens can act as funders, e.g. via crowdfunding, and evaluate research results. Citizen Science adds important dimensions to the democratisation of science and responsible research and innovation. There is broad consensus that participatory approaches could foster active engagement instead of passive audiences and co-shape science and technology development. Moreover, Citizen Science provides many opportunities for children and students to be involved in scientific practices.

Source: Mayer, (2015)

[7] Open Citation initiatives: http://opencitations.net and https://i4oc.org/

Of course, openness both in and to research has manifold meanings and expressions. Depending on how, for whom, when, and where openness occurs, different values and practices are highlighted or obscured (Levin, et al., 2016). Furthermore, Open Science is not an "all or nothing game" (Bosman & Kramer, 2017). Acknowledging the many shades of openness helps to identify priority approaches in research practices and research communities (Pomerantz & Peek, 2016). Therefore, the whole spectrum of openness cannot (and certainly should not) be moulded into a top-down STI policy, although the focus on several cross-cutting aspects promises to leave enough room for diverse manifestations of openness.

In recent years, the European Commission has established a broad catalogue of measures to initiate, adopt and further promote a systematic and paradigmatic shift towards collaboration, sharing and sustainability in publicly funded research: starting from Open Access to Publications and Research Data in the current Framework Programme Horizon 2020,[8] building necessary infrastructures following the vision of an European Open Science Cloud,[9] and envisioning more openness in evaluation and hiring procedures (Working Group on Rewards under Open Science, 2017),[10] as well as building the foundations for skills and competencies for the next Framework Programme FP9. For FP9, Europe envisions Open Science in every aspect of the research cycle while determining rights and obligations: aligning principles of FAIR data sharing with intellectual property regulation and exploitation opportunities, broadening Open Access to other forms of research output, requiring institutions to assume responsibility and introduce adequate open policies, and introducing new-generation metrics for assessing output and both scientific and societal impact (Burgelman, 2017).

Europe – along with its G7 partners - follows the idea that only a good balance of regulation and incentives for Open Science will foster collaborative, transparent and accessible research across all scientific processes and strengthen and increase productivity and social impact. The goal is to achieve inclusive growth and benefits for all citizens by placing science, research and innovation at the centre of the common political agenda.[11]

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[8] Within Horizon2020, OA is also integrated into The European Code of Conduct for Research Integrity https://ec.europa.eu/research/participants/data/ref/h2020/other/hi/h2020-ethics_code-of-conduct_en.pdf, as well as the FAIR principles http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/oa_pilot/h2020-hi-oa-data-mgt_en.pdf , thus OA and ORD are now included in the legal basis for grant agreements within European research frameworks.

[9] European Open Science Cloud – EOSC: https://ec.europa.eu/research/openscience/index.cfm?pg=open-science-cloud

[10] The Open Science Career Assessment Matrix OS-CAM: https://ec.europa.eu/research/openscience/pdf/os_rewards_wgreport_final.pdf, pp. 5-6.

[11] The G7 Science Ministers' communiqué: http://www.g7italy.it/sites/default/files/documents/G7%20Science%20Communiqu%C3%A9.pdf

It is therefore crucial to see European Open Science activities embedded in a larger international context of interlinked visions, strategies and policies. Member States and Associated Countries are working together in the European Research Area Committees (ERAC) in furthering the advancement of Open Science and ERA implementation (priority of an open labour market for researchers and priority of optimal circulation and transfer of scientific knowledge), and are discussing how best to align various other EU policies and treaties[12] with the implementation of Open Science. Moreover, Open Science principles are being adopted on a global scale by governments, funders, research-performing organisations and individual researchers. The G7 science ministers recently signed a memorandum on international coordination of the development of incentives and infrastructures for Open Research. Some of the world's biggest charities and private funders have become allies in the Open Research Funder Group ORFG.[13] The OECD[14] and UNESCO[15] are calling for better policies and legal frameworks for the conduct of Open Science across its full range. In the USA, major agencies (such as the NIH, NSF, etc.) are following the 2013 White House memorandum[16] by developing Open Science policies. Asian, South American and African countries are also increasingly engaging in Open Science activities, mobilising multiple bottom-up initiatives, developing Open Access strategies, while some are already enforcing OA mandates.[17]

Mainstreaming Open Science and aligning it with multi-level interests, national priorities and international policies require strong leadership and sophisticated negotiation and communication strategies. Pan-European projects (e.g. OpenAIRE and PASTEUR4OA)[18] which often act as drivers for the development of national approaches, assemble key expertise in the co-design of strategies and policies while keeping an eye on the collateral effects of science policies. Furthermore, in Europe, we are facing different velocities in the uptake of Open Science both within research communities, and research and education

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[12] Such as the European Research Area - ERA (Treaty on the Functioning of the European Union TFEU http://ec.europa.eu/research/era/art-185_en.htm), Agenda 2030 https://ec.europa.eu/europeaid/policies/european-development-policy/2030-agenda-sustainable-development_en and others.

[13] The Open Research Funders Group http://www.orfg.org, Gates Foundation, Open Society Foundations, Wellcome Trust, etc.

[14] OECD Open Science initiative: http://www.oecd.org/science/openscience.htm

[15] The UNESCO Global Open Access Portal: http://www.unesco.org/new/en/communication-and-information/portals-and-platforms/goap/

[16] The White House Memorandum on 'Increasing Access to the Results of Federally Funded Scientific Research (2013)':https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/ostp_public_access_memo_2013.pdf

[17] For instance, Mexico is developing national OA legislation, India is tying funding to OA, and the Chinese Academy of Sciences has created its own OA policy. For more information see: https://innovationpolicyplatform.org/content/open-science-country-notes

[18] OpenAIRE https://www.openaire.eu/ and http://www.pasteur4oa.eu/

policies.[19] The unifying aspect in this diverse landscape is the opportunity for broad international debate about the social function of publicly funded research and the current state of research systems. This provides an opportunity to renegotiate the social roles of science, their links to inclusive growth, societal well-being, education and industry and to ask how multi-level agendas and interests can best be converged.

The 2016 Amsterdam Call for Action[20] outlines the most important policies underpinning the adoption of Open Science:

- A new assessment, reward and evaluation system that accounts for the manifold ways of producing and sharing knowledge, including beyond science and within society at large.

- The alignment of policies and exchange of best practices on cross-national and inter-institutional level. This should increase not only comparability but should also support concerted actions accompanied by regular monitoring-based stocktaking.

Therefore, this MLE was dedicated to discussing core challenges policymakers, funders, research administrators and researchers are facing when redesigning how scientific quality and impact is assessed, and which incentives and rewards should be developed to gradually replace a self-referential and hypercompetitive system, which has both harmed scientific integrity and discouraged social engagement. Thus, the next section will briefly summarise the findings of the thematic reports and group discussions prepared by the experts before discussing what our exercise has taught us in the following chapters.

3.2 Incentivising and rewarding Open Scholarship

Open Science affects how:

- Research is done and knowledge is produced;

- Knowledge is shared, circulated, reused and preserved across disciplines and beyond science;

- Research is valuated and researchers are rewarded;

- Research is funded and incentivised;

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[19] For an overview of OA, see https://www.openaire.eu/member-states-overview; for an overview of Open Research Data, see SPARC Europe report: https://sparceurope.org/new-sparc-europe-report-analyses-open-data-open-science-policies-europe/

[20] The Amsterdam Call for Action is based on the outcomes of the Conference 'Open Science – From Vision to Action', hosted by the Netherlands' EU Presidency on 4 and 5 April 2016. https://www.government.nl/documents/reports/2016/04/04/amsterdam-call-for-action-on-open-science

- Researchers are trained[21].

It has already been well documented that Open Scholarship increases citations and media attention, broadens networks of potential collaborators, and creates new job and funding opportunities for researchers (McKiernan et al., 2016). Publicly funded research in the open benefits all of society: it is undoubtedly advantageous if research outputs can be openly evaluated, replicated, engaged with, and reused both as common goods and commercialised (Frischmann, Madison, & Strandburg, 2014).

However, the conceptualisation and discussion of Open Science principles and implementation brought attention not only to the opportunities, such as increased visibility and transferability of scientific knowledge, but also to the challenges and hindrances that prevent the broad uptake of open scholarly practices.[22.] These include diversity in epistemic cultures and quality assurance criteria; cost, accountabilities and long-term sustainability; lack of skills and training; intellectual property concerns, legal insecurities, and semantic ambiguity; ethical concerns, privacy and data protection; imbalance towards high resource and already strong research environments; and last but not least, the missing orientation of evaluation and credit systems towards Open Science.

Currently, the academic reward system rests mainly on the 'publish or perish' rationale, privileging quantity, speed and patentability over quality, sustainability and reusability. The emphasis is on the (over-)production of one type of output – the article in international top journals, rather than allowing broad diversity, not only in publication outlets, but also in types of outputs.

The current ways of making assessments are further disconnecting scientific knowledge production from societal concerns and engagement. Open Scholarship is hardly acknowledged, and even less rewarded in traditional academic evaluation regimes. Hence, decisions to follow alternative, open routes in research may result in disadvantages for scholarly career progression.[23]

Understanding the interplay of research valuation and the conditions of knowledge production is a prerequisite of co-designing successful Open Science strategies (and policies). Furthermore, it is the basis for a careful reorganisation of evaluation procedures and mechanisms that take into account established reward cultures and the pressures of the hypercompetitive systems (young) researchers are confronted with today. Therefore, researchers and research communities, including learned society, must participate in all negotiations and developments – they should even have a determining influence.

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[21] Adapted from Burgelman, (2017)

[22] See also European Commission, (2018c), p 9

[23] For further information, see: Hicks, Wouters, Waltman, De Rijcke, & Rafols, (2015); Wilsdon, (2016); and Munafò et al., (2017);

3.2.1 Altmetrics

Metrics serve key functions in any research system. They serve as proxies for evidence-based decision-making: public spending on research should rest on robust mechanisms reflecting responsibility and trust. They also enable quality control within research institutions and society at large. However, conventional metrics for research assessment mainly focus on research outputs, namely journal publications (number of, and citations to). Data are commonly derived from commercial bibliometric databases, such as Web of Science or Scopus,[24] which have established themselves over the years as costly gatekeepers of the academic reward system, equipping it not only with the data but also with sets of indicators and impact metrics such as the now infamous – but still widely used - "journal impact factor". It has been argued that such a simplistic use of metrics is far from being a "robust indication" of research quality (European Commission Expert Group on Altmetrics, 2017a). Bibliometrics – or more specifically scientometrics – should always be used in synopsis with multiple indicators, and most importantly in combination with qualitative review (Hicks, et al., 2015).

Intensified use of simplistic metrics in research evaluation reflects an increased audit-driven culture that tends to neglect aspects that cannot be (easily) measured. It may hamper innovation by flattening out diversity and creating all sorts of bias, such as risk avoiding, the non-reporting of negative results, and many more.[25] The "impact of the impact factor" has to be considered with every metric deployed. No matter how well developed an indicator is, the moment it becomes a prominent measure of research assessment it will influence and co-shape what it measures and, in the worst case, become the target.

As it becomes increasingly important to monitor and assess how research is actually being used, not only within the research system but also in other societal realms, and how outputs are shared, discussed and taken up, funders and policymakers alike are looking for alternative indicators to produce evidence of broader research impact. Altmetrics (short for alternative metrics),[26] measure usage or online mentions of research outputs, including in unconventional outlets, such as databases, news media, blogs, Wikipedia, policy documents and many more. Such metrics promise to uncover previously invisible aspects of Open Scholarship as their focus is directly on the online outputs or activity surrounding them. Hence, dissemination could be tracked in almost real time both within and beyond academia, paying attention to the output even before publication in a journal and being cited. In addition, altmetrics could be applied to data sets, blog posts, reviews and many more forms of scientific outputs. Providers of altmetrics, such as Altmetric.com, Plum

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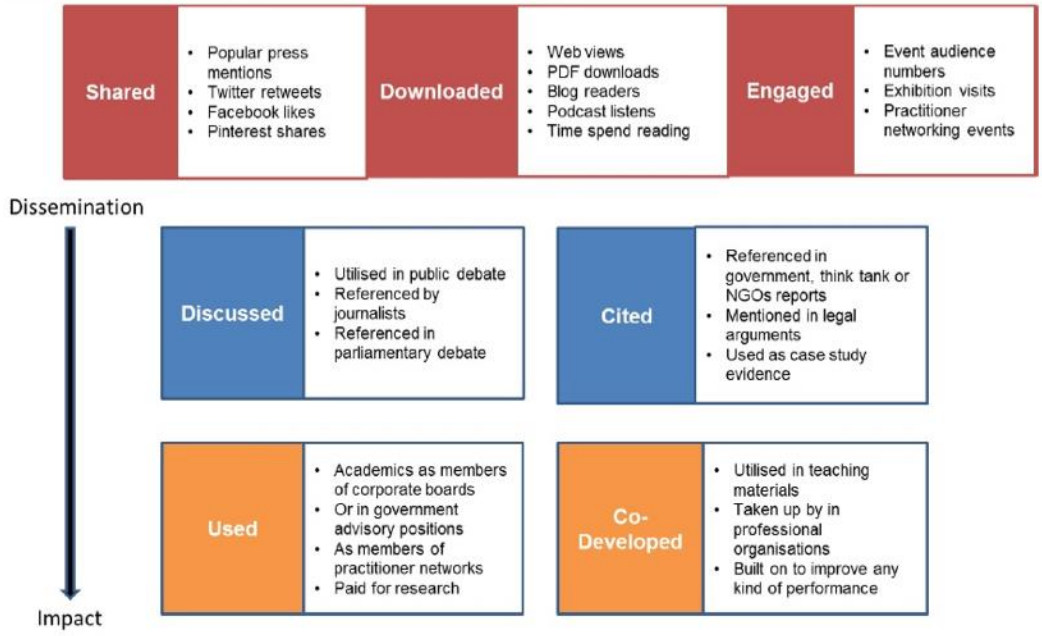
[24] Web of Science: http://wokinfo.com/ ; Scopus: https://www.elsevier.com/solutions/scopus

[25] For a discussion of the limits of metrics, see (Benedictus, Miedema, & Ferguson, 2016); (Collini, 2016); (Haustein, Bowman, & Costas, 2015a); (Peters et al., 2014); (Sarewitz, 2016).

[26] Altmetric(s) is also the brand name of a company: http://www.altmetric.com

Analytics and Impact Story,[27] aggregate online data from various sources, and some offer part access to their data streams via application programming interfaces (APIs).

Figure 3: The Metric Tide: Report of the Independent Review of the Role of Metrics in Research Assessment and Management.



Source: Wilsdon, 2016

However, the use of altmetrics raises several substantive concerns. One is that it is not clear what kinds of qualities altmetrics indicate and what kind of attention clicks and downloads represent (Haustein, Bowman, & Costas, 2015b). Another is that providers are themselves not fully open in terms of the methods, algorithms and data they employ. Hence, results are hardly replicable, and their usage in decision-making is neither standardised nor transparent. Alternative and conventional metrics alike need to be more open: making data sources and their documentation accessible, making methods available, and introducing guidelines for their usage (OpenAire, 2016 and European Commission 2018b). Moreover, with all types of metrics we need to discuss what matters, and what kind of research qualities and societal impacts or benefits we would like to see.

[27] https://plumanalytics.com/ and https://impactstory.org/

Measure what matters: what matters in open science?

Innovative metrics should be designed for those qualities and impacts that are most valued by societies. Moreover, they should be able to make any format of research output visible, be it data, blogs, workflows and so on. The 2017 report of the European Commission Expert Group on Altmetrics 'Next-generation metrics: Responsible metrics and evaluation for Open Science' describes a framework for innovative metrics and their responsible use in line with the European agenda for Open Science. The authors define the two main objectives of metrics for Open Science:

1. Monitoring the development of the scientific system towards openness at all levels

2. Measuring performance in order to reward improved ways of working at group and individual level.

These objectives call for the development of new indicators and the responsible and FAIR revision of conventional metrics. Moreover, they point to the necessity of establishing new openly accessible data sources along new infrastructures, such as interlinked repositories, digital tools and scholarly communication platforms in order to incentivise both research quality and open practices.[28]

"Open science and altmetrics both heavily rely on (open) web-based platforms, encouraging users to contribute (via likes, shares, comments, etc.). Altmetrics, then, are both drivers and outcomes of Open Science practices. More specifically, altmetrics can stimulate the adoption of Open Science principles, i.e. collaboration, sharing, networking".[29]

The expert report – acknowledging the necessity for evidence of the benefits Open Science brings to science within society – concludes with a set of recommendations that will guide the European Commission's next strategies:[30]

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[28] See current call for 'open citations' (Shotton, 2018). This would also help to establish responsible open metrics. Furthermore, a legal framework for text and data mining (TDM) is needed in that context.

[29] See the Thematic Report 2, European Commission (2018b), p.11

[30] Cited from (European Commission Expert Group on Altmetrics, 2017b) in reference to the recommendations of the Open Science Policy Platform: https://ec.europa.eu/research/openscience/pdf/ospp_metrics_wg_recommendations_final.pdf

Figure 4: Recommendations by the European Commission Expert Group on Altmetrics, 2017

Fostering Open Science

- Provide clear guidelines for the responsible use of metrics in support of open science
- Encourage the development of new indicators and assess the suitability of existing ones to support the development of Open Science
- Test new metrics and their consequences before including them in evaluation criteria.

Removing barriers to Open Science

- The adoption and implementation of Open Science principles and practices should be recognised and rewarded through the European research system
- Highlight how the inappropriate use of indicators can impede progress towards Open Science
- All sets of metrics should include Open Metrics to enable proper validation

Developing research infrastructure for Open Science

- Advocate for linked metadata standards as the basis for open, publicly available data infrastructure
- Propose a mandatory set of unique identifiers (such as ORCID and DOI)
- Reduce emphasis on journal impact factors

Embed Open Science in society

- Identify mechanisms for promoting best practices, frameworks and standards for responsible use of metrics in support of Open Science
- Establish a European Forum for Next-Generation Metrics
- Focus on FP9 and the design of a next-generation research data infrastructure

Several European countries have already tested the use and feasibility of alternative metrics in pilot studies (e.g. Austria, Finland, Slovenia), but with the exception of Moldova, altmetrics are not used for research evaluation. However, the participating countries in the MLE are aware of altmetrics and some organisations have integrated altmetrics into their repositories. In Slovenia, altmetrics are displayed in researchers' bibliographies and in the COBISS/SCIMET portal, which aggregates data about scientific outputs for research assessment. In this case, altmetrics are used in combination with traditional indicators from Web of Science and Scopus. For a detailed summary of the current status of altmetrics use in participating countries, please refer to the thematic reports 1 and 2 (European Commission 2018a and 2018b).

Several initiatives are promoting the opening of metadata, and the move away from proprietary data sources. The objective of the OpenCitations initiative[31] – an open scholarly infrastructure organisation – is to host and build the OpenCitations Corpus (OCC), an RDF database of scholarly citation data. OpenCitations is part of the Initiative for Open Citations I4OC that requests all scholarly publishers to make article-based references openly available via Crossref.[32] Another imitative – the oaDOI, now Unpaywall – searches for OA versions of a paper and is another step towards building open index systems and creating new forms of visibility for Open Science (Bosman & Kramer, 2018).

However, the most important questions remain: what do we want to measure? What should be regarded as evidence for "demonstrable contributions"[33] of science in society? What is good impact?[34] In addition, we need to continue the debate on how to responsibly use metrics in research e/valuation and how they can support the development of incentives and rewards for Open Scholarship.

3.2.2 Incentives and rewards

The European Commission is currently envisioning strategies to encourage open practices. Identifying next generation metrics – an alternative term to altmetrics proposed by the expert group[35] – and ensuring their uptake in reward systems is just one part of this endeavour, which also requires nothing less than a fundamental paradigm shift in evaluation, recruitment and funding systems.

It has already been stated that we now have the opportunity to improve the publicly funded research system by implementing Open Science principles. Potential improvements include (European Commission 2018c, pp.7-8):

- Increased efficiency, quality, and sustainability of discoveries
- Better communication, engagement and teaching practices
- More encouragement of other, relevant forms of research output, transfer and public engagement
- Transparency of methods and sources and thus increased research integrity
- Enhanced ways of collaboration and inter- and transdisciplinary exchanges

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[31] The corpus of http://opencitations.net now contains almost 13 million citation links.

[32] The Initiative for Open Citations: https://i4oc.org

[33] Research Council UK: http://www.rcuk.ac.uk/documents/documents/ptoiexecsummary-pdf/ ; see also the MLE Thematic Report 1 European Commission (2018a), p.6ff.

[34] See the section on impact of the MLE Thematic Report 1, European Commission, (2018a).

[35] See European Commission Expert Group on Altmetrics, (2017b)

- Better reliability and timeliness in tackling societal challenges
- Raising public trust in science through participation

However, these improvements can only be effective if the main stakeholders in the research system – researchers, research-performing organisations, funders and governments – engage actively and collaboratively in the implementation of Open Science. A balanced approach involving "sticks and carrots" (Leonelli, Spichtinger, & Prainsack, 2015) will help to involve researchers across all stages of Open Science, and for a more systematic support and promotion of it by funders and research-performing institutions. As this MLE focused more on incentives and rewards (the "carrots"), for now we will ignore the debate about the "sticks" (regulation, sanctions, etc.). However, it is necessary to differentiate the types of incentives and rewards per stakeholder, combining implemented and envisioned ones in order to grasp the scope of changes needed.

Incentives and rewards for Open Science: researchers

"Today, I wouldn't get an academic job. It's as simple as that. I don't think I would be regarded as productive enough" (Peter Higgs in The Guardian, 6 Dec 2013)

Researchers are subject to requirements made by their peers, disciplinary communities, home institutions and funding bodies, which constitute the room for manoeuvre a researcher has. In today's highly competitive academia, many researchers are nervous about sharing data, methods and materials, for fear of being "scooped" and losing their competitive advantage. Shifting these perceptions, moving away from the current "publish or perish" culture and making sure that researchers are rewarded for Open Science behaviour are among the most important goals of Open Science policies. However, any approach to incentivising Open Scholarship needs to consider the traditional reward system and provide enough points of reference not to establish a parallel system. What types of incentives and rewards are already in action or could be implemented in the future?

Adequate sets of metrics could play their part in raising visibility and recognition, while linking open practices with performance evaluation has proven to be a very effective measure, especially when made mandatory.[36] However, what about the lack of recognition for all other types of open practices? Following three important documents: 1) 'Inclusive set of indicators for research impact' by Science in Transition;[37] 2) 'Promoting openness in professional advancement practices' by the Promotion & Tenure Reform working

[36] Such as Open Access publishing and Open Data sharing; see Liège Model (Rentier & Thirion, 2011); moreover, the Open Science Skills Report (Europen Commission Open Science Skills Working Group, 2017), p 21, and the Open Science Rewards Report (Working Group on Rewards under Open Science, 2017).

[37] Science in Transition: http://scienceintransition.nl/en/

group of the Open Scholarship Initiative 2017;[38] and 3) 'Evaluation of Research Careers fully acknowledging Open Science Practices by the European Commission working group on Open Science Rewards'[39] – and a range of declarations and manifestos dedicated to improvement in the research system,[40] the list of general measures for relevant incentives and rewards includes:[41]

- **Assessment and promotion criteria**: fair assessment of research efforts, resulting in incentives to produce better and more rigorous science

- **Improved training and support** for research dissemination and data curation

- **Fairer distribution of authorship claims and citation cultures**, including other forms of research output such as data sets, workflows, etc. and taking into account non-traditional dissemination platforms, such as social media and collaboration environments (e.g. Github)

- **Reliable Open Science infrastructures**, with guarantees that can support researchers' work in the long term and incentives for researchers to use them (e.g. funding, innovative services, link to performance evaluation, etc.)

- **Visible recognition of Open Science activities** (including Citizen Science and Open Education), used widely to enhance reputation and credibility of researchers, establishment of Open Science prizes, and encourageing champions and role models

- **Legal security, harmonised institutional open policies and support in licensing decisions**, fostering the synergies of knowledge commons and commercialisation routes.

The ERA Priority 3 promotes greater transparency and diversity in recruitment procedures and evaluation mechanisms, which are vital for career progression and access to research funding grants. The Open Science Career Assessment Matrix below provides further details of potential types of acknowledgement of researchers' often invisible work. This matrix is discussed and developed further

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[38] Open Scholarship Initiative: http://osinitiative.org/

[39] See above footnote 39

[40] Vienna Principles http://www.viennaprinciples.org, DORA Declaration https://sfdora.org/ , Force 11 https://www.force11.org/ , etc. There is also a very interesting project examining the review, promotion and tenure (RPT) process in the United States and Canada: https://www.scholcommlab.ca/research/rpt-project/progress/

[41] Adapted from European Commission (2018c), pp.18-22.

with the objective of becoming a blueprint for guidelines used in review, promotion, and tenure processes and beyond.[42]

Table 2: OSCAM Open Science Career Assessment Matrix scheme
(Working Group on Rewards under Open Science, 2017)

Open Science Career Assessment Matrix (OS-CAM)	
Open science activities	**Possible evaluation criteria**
RESEARCH OUTPUT	
Research activity	Pushing forward the boundaries of open science as a research topic
Publications	Publishing in open access journals Self-archiving in open access repositories
Datasets and research results	Using the FAIR data principles Adopting quality standards in open data management and open datasets Making use of open data from other researchers
Open source	Using open source software and other open tools Developing new software and tools that are open to other users
Funding	Securing funding for open science activities
RESEARCH PROCESS	
Stakeholder engagement / citizen science	Actively engaging society and research users in the research process Sharing provisional research results with stakeholders through open platforms (e.g. Arxiv, Figshare) Involving stakeholders in peer review processes
Collaboration and Interdisciplinarity	Widening participation in research through open collaborative projects Engaging in team science through diverse cross-disciplinary teams
Research integrity	Being aware of the ethical and legal issues relating to data sharing, confidentiality, attribution and environmental impact of open science activities Fully recognizing the contribution of others in research projects, including collaborators, co-authors, citizens, open data providers
Risk management	Taking account of the risks involved in open science

[42] Could also be used as criteria for the Human Resources Excellence in Research Award (HRS4R); Taken from Open Science Rewards Report (Working Group on Rewards under Open Science, 2017) p. 8.

SERVICE AND LEADERSHIP	
Leadership	Developing a vision and strategy on how to integrate OS practices in the normal practice of doing research Driving policy and practice in open science Being a role model in practicing open science
Academic standing	Developing an international or national profile for open science activities Contributing as editor or advisor for open science journals or bodies
Peer review	Contributing to open peer review processes Examining or assessing open research
Networking	Participating in national and international networks relating to open science
RESEARCH IMPACT	
Communication and Dissemination	Participating in public engagement activities Sharing research results through non-academic dissemination channels Translating research into a language suitable for public understanding
IP (patents, licenses)	Being knowledgeable on the legal and ethical issues relating to IPR Transferring IP to the wider economy
Societal impact	Evidence of use of research by societal groups Recognition from societal groups or for societal activities
Knowledge exchange	Engaging in open innovation with partners beyond academia
TEACHING AND SUPERVISION	
Teaching	Training other researchers in open science principles and methods Developing curricula and programs in open science methods, including open science data management Raising awareness and understanding in open science in undergraduate and masters' programs
Mentoring	Mentoring and encouraging others in developing their open science capabilities
Supervision	Supporting early stage researchers to adopt an open science approach
PROFESSIONAL EXPERIENCE	
Continuing professional development	Investing in own professional development to build open science capabilities

Project management	Successfully delivering open science projects involving diverse research teams
Personal qualities	Demonstrating the personal qualities to engage society and research users with open science Showing the flexibility and perseverance to respond to the challenges of conducting open science

Source: Working Group on Rewards under Open Science, (2017)

Incentives and rewards for funding bodies and research institutions[43]

"Open Science is a means, not an end." (OECD, 2015)

Higher education institutions (HEIs) and other research-performing organisations play a crucial role in implementing and enabling Open Science activities through the right incentives and evaluative mechanisms. Funding bodies also provide significant incentives to both institutions and researchers by establishing criteria for resource allocation. These stakeholders are also on the frontline in terms of complying with the EU Open Science mandate by 2020, particularly in countries (such as Switzerland and France) where HEIs operate with a large degree of autonomy from central government. Furthermore, visions and strategies of research institutions and funders influence the attitude towards Open Science not only of researchers, but also of policymakers and society at large. The establishment of new open policies as well as incentives must be accompanied by the right narratives and communication strategies. Furthermore, within and across research institutions (including archives and memory institutions) research services and libraries have gathered not only vast expertise by dealing with issues of Open Access and data sharing, but have also been among the first bottom-up driving forces in Open Science discourse. For many years, these stakeholders have firmly established international networks[44] for exchange, been part of political pressure groups and lobbies, and have been instrumental in both public debate and operationalisation.

To date, most funders' policy mandates of relevance to Open Science activities have focused on the implementation of Open Access, and specifically on mandating Open Access archiving. In countries such as the UK, the Netherlands and Moldova, open archiving has become compulsory for publications wishing to be counted as part of governmental assessment exercises, leading to most universities developing in-house archival services. The majority of European funders have been more reluctant to mandate Open Access publishing, a situation that is partly explained by unresolved issues around who bears responsibility for the associated costs and by ongoing disputes with publishers, learned societies and universities around Open Access publishing models and related metrics. The situation on Open Data is even more striking, with few

[43] Adapted European Commission (2018c), pp.24-28.

[44] OpenAIRE, LIBER, etc.

funders in Austria, Finland, Hungary, Ireland, Italy and Sweden so far committing to piloting or already mandating data sharing, while the vast majority of funders remain neutral. The reasons for such reluctance include difficulties in tackling the diversity of data types and uses, researchers' own reluctance in sharing their data, as well as the lack of rewards associated with this highly laborious practice. Making sure that data production is documented and visualised with enough detail to enable others to replicate it, and formatting data and related metadata in ways that comply with international standards for data curation, are activities that require considerable time and expertise, and which therefore reduce the time researchers have for other activities. These issues can only be resolved with extensive and careful debate among stakeholders, such as exemplified by the Open Science Policy Platform. Below are some of the **incentives and potential rewards** for European research-performing institutions and funding bodies **to support Open Science activities**:

- Fostering interdisciplinary and translation research; bringing together impact and engagement with scientific excellence; providing links between high-quality and commercially attractive research; and facilitating local and international collaboration

- Promoting social engagement and responsible innovation; fulfilling the third mission; and increasing public trust and interest in higher education and research

- Enhancing open educational resources; engendering novel approaches to teaching; and bringing timely and state-of-the-art research into classrooms

- Highlighting the importance of infrastructures and promoting their further development; alignment with Current Research Information Systems (CRIS); and providing training for the necessary skills in close cooperation with libraries, data centres and researchers

- Improving management practice by news monitoring of research performance (e.g. linked to repositories and OA); new indicators for prospective research and future potential; highlighting strengths and skills; and helping to diversify talent management and research services, in line with a soon to be revised 'Human Resource Strategy for Researchers' incorporating the European Open Science agenda

- Improving transparency and external accountability based on rich and diverse sources of evidence, and by exploring benefits of open peer review, by highlighting and opening knowledge production in local languages, by dealing openly with IPR issues, and by fostering research ethics, e.g. via data management plans

- Enhancing international visibility and reputation, e.g. by including OSCAM criteria in guidelines; enabling institutions to compete on international job markets; and attracting talent and investments.

Incentives and rewards for national governments[45]

"A recent study analysed the economic impact of opening up research data. Using the example of the European Bioinformatics Institute at the European Molecular Biology Laboratory, the study demonstrated that the institute generates a benefit to users and their funders of around EUR 1.3 billion per year – just by making scientific information freely available to the global life science community. This is equivalent to more than 20 times the direct operational cost of the institute!" (Moedas, 2016)

While it is widely acknowledged that Open Science initiatives and practices need to emerge 'bottom-up', thereby aligning with researchers' experiences and needs, top-down legislation serves a crucial role as a framework within which incentives can be positioned and motivated. National governments need to take responsibility for fostering Open Science activities and making it as easy as possible for researchers, research institutions and funders to implement the required changes.

From international discourse and the discussions held during the course of the MLE, it is clear that the vast majority of researchers and research institutions expect national governments to explicitly endorse Open Science policy and provide resources and funding to support and coordinate its implementation across all relevant stakeholders. This is a key incentive for the uptake of Open Science activities, since it signals that the country is prepared to recognise and reward those willing to challenge traditional approaches to research and publishing, and encourage concerted action. Moreover, in countries where universities and research-performing organisations have little autonomy, relevant ministries or agencies bear an even greater responsibility for setting the Open Science agenda.

Therefore, it is vital that policymakers embrace the benefits Open Science could bring on a national perspective. Thus, incentives for national governments and policymakers can be developed from the following objectives:

- Improving transparency and external accountability of national research performance and infrastructures (including transparencey of public expenditure on publication systems)

- Promoting social engagement and responsible innovation, fostering better collaboration of academia and industry, involving citizens in co-design and evaluation of research activities, better managing public perceptions

- Economic growth and a better documentation of impact, value production and return of investment (see quote above) based on opening up research for reuse (understanding the socio-economic potential of knowledge commons)

[45] Adapted from European Commission (2018c), pp.29-31.

- Enhancing international relations, science diplomacy bringing science policy in close alignment with foreign policy goals and procedures in the spirit of international solidarity, solving common and complex societal challenges.

3.3 National initiatives for open science[46]

Since national government endorsement of Open Science is a key incentive for all relevant stakeholders to continue its development and implementation, this report also gathers MLE participants' experiences to review the current state of national policies or related actions for incentivising researchers and research institutions to engage with Open Science. The aim is to contribute to the ongoing discussion on how and which Open Science principles and requirements could be set up to affect the roles, responsibilities and entitlements of researchers, their employers and funders, and in which ways they should be prioritised in the process of implementation.

Figure 5: Dutch National Plan Open Science – Declaration

Source: https://www.openscience.nl/en/national-plan-open-science

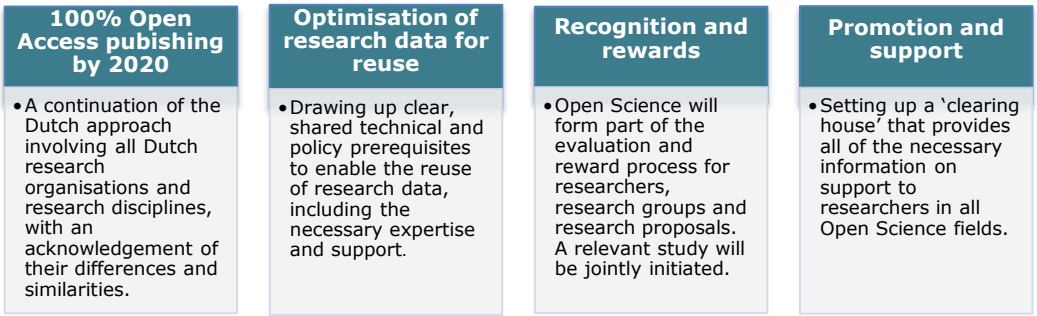
Whereas several European governments either have Open Access policies in place or have recommended them to public research institutions, only the Dutch and Finnish governments have developed national initiatives for Open Science so far.

[46] This section is adapted from European Commission, (2018d), pp.7-9.

The Finnish Ministry of Science and Education endorses Open Scholarship through the 'Open Science and Research Initiative',[47] which was set out for the period 2014-2017 to ensure the societal impact of Open Science. A concise framework and a roadmap guided the implementation, and methods for monitoring (Finland's Ministry of Education and Culture, 2018) were tested and used and are now being evaluated. Four objectives were defined: reinforcing the intrinsic nature of science and research, strengthening openness-related expertise, ensuring a stable foundation for the research process, and increasing the societal impact of research. These objectives were accompanied by a set of measures to achieve these sub-objectives. The Finnish initiative is based on broad, multiple-stakeholder cooperation between ministries, universities, research institutions and research funders.

Similarly, the Dutch national plan rests on the collaboration of a broad range of stakeholders. It outlines the current and planned activities of those stakeholders.[48] The objectives are are presented in Figure 6 :

Figure 6: Objectives of the Dutch National Plan for Open Science



In line with the Amsterdam Call for Action on Open Science, published in April 2016, and the conclusions of the Competitiveness Council from May 2016, these objectives form the core of the national plan as outlined in a letter to the Dutch parliament by the State Secretary of Education, Culture and Science in January 2017. By 2020, Open Access publishing and sharing of research data should become the norm across publicly funded organisations and scientific communities in the country.

Other European countries follow the example: Sweden is now in the process of finalising its own national agenda, which was formulated in the Research Bill of November 2016.[49] The National Library of Sweden and the Swedish Research

[47] Finnish Open Science portal on the web: http://www.openscience.fi

[48] National Plan for Open Science in the Netherlands: https://www.openscience.nl/en/national-plan-open-science/national-plan/summary/index

[49] Press release: http://www.government.se/press-releases/2016/11/collaborating-for-knowledge--for-societys-challenges-and-strengthened-competitiveness/

Council have received a government assignment to nationally coordinate Open Access in publications and research data. The French government is also taking practical steps, most notably by implementing a new legal framework that enables researchers to publish their last preprint wherever they want, thereby giving legal security to Green Open Access publishing and secondary publication or preprints.[50] France is now developing a communication strategy to explain to stakeholders how to use this framework. Portugal is also developing a plan for Open Science in line with the ERA roadmap, which is in its early stages of discussion and implementation;[51] and Bulgaria discussed and approved a national Open Science strategy in its parliament in the summer of 2017.

There was considerable consensus among the participants in this MLE that a national agenda on Open Science is crucial to the development and coordination of strategies for implementation by funding agencies, research institutions, learned societies and publishers. This is particularly the case for countries where the state plays a significant role in the governance of research institutions, such as, for instance, Croatia, Latvia, Slovenia, Moldova and Italy. Countries where research institutions have a large degree of autonomy from the state, like Sweden and the Netherlands, are less affected, although even there the presence of a national agenda with clear priorities and division of labour greatly facilitates coordination among stakeholders. This is also the case for rather decentralised, bottom-up systems, such as in Switzerland.

It is too often the case that some groups of stakeholders (often researchers or librarians) invest considerable effort in a specific strategy for Open Science implementation, without the means and the mandate to coordinate with other stakeholders, and without the backing of government or international agencies. In those cases, there is a high risk of remaining invisible at the national and international level, and thus of failing to advance the overall development of Open Science in Europe. For such bottom-up initiatives to become visible and create useful models and learning experiences for others, national governments should:

1. **Implement a national Open Science strategy matching that outlined by the European Commission; and**

2. **Establish clear points of contact and coordination which can ensure constructive and fruitful dialogue and collaboration among all stakeholders.**

This is easier and most effective to implement in small countries with centralised governance, such as Latvia, Moldova and Slovenia, where in principle at least, it is possible to gather together many relevant stakeholders in the same place. It is more complex in countries with a federal or divided structure, such as Belgium and Switzerland. The establishment and

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[50] For more information: https://blogs.openaire.eu/?p=1602

[51] Portugal Open Science portal: http://www.ciencia-aberta.pt/

implementation of a national agenda is therefore likely to vary considerably across countries. The presence of informal networks, such as the Open Access Research Network in Austria OANA,[52] can be of considerable assistance for acquiring and coordinating feedback and input for governmental action.

In highly federated countries, research institutions tend to have a higher degree of autonomy with respect to central government, and are thus playing an important part in fostering Open Science developments at the national level. This is true of Switzerland, where the federal government simply mandated that Swiss universities develop a national Open Access strategy in collaboration with the Swiss National Science Foundation SNF.[53] The SNF is also playing a leading role by fostering debate around Open Access and Open Data, not least by supporting the development of the National Open Access Strategy and mandating data management plans (DMPs) for all projects funded from October 2017 onwards. Similarly, in Austria, the Federal Ministry of Science, Research and Economy (BMWFW) has promoted the initiative 'Austrian Transition to Open Access - AT2OA' by funding 21 universities to work together towards achieving this goal.

In Belgium, there is a federal Open Science mandate coordinated by the Belgian Science Policy Office (BELSPO), which is limited, however, to the federally governed research institutes. Universities and various other research institutes are governed at the regional level and not implied in the federal policy. In Flanders, there is a particularly active discussion around implementing Open Data through mandating DMPs for publicly funded research, thereby fostering its implementation at the regional level, while in the Wallonia-Brussels Federation, a decree is being prepared which will mandate Green Open Access for all publicly funded research.

There are instances where bottom-up Open Science initiatives are overtly clashing with national research governance systems, and this is where discussions on Open Science implementation at the national level are most urgently needed. A case in point is Croatia where, although there are multiple sophisticated initiatives by researchers and research institutions (see below), national research evaluation continues to privilege quantitative metrics, such as the number of publications and impact factors.

There are also cases where national strategies have yet to be implemented, or are hard to implement because of a Member State's specific political situation. In Slovenia, for example, a novel legislative framework and governmental buy-in is needed to support the many Open Science activities in research institutions and learned societies. In Armenia, for instance, there are no extensive and explicit plans at the national level yet, although steps are being taken to develop a national Open Access strategy and a related repository for Open

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[52] Austrian Open Access Network: http://www.oana.at

[53] Swissuniversities Open Access strategy:https://www.swissuniversities.ch/fileadmin/swissuniversities/Dokumente/Hochschulpolitik/Open_Access/Open_Access_strategy_final_e.pdf

Access publications. Countries which are less advanced in their implementation of Open Science have the advantage of being able to learn from other experiences and implementing several useful steps at the same time, such as including Open Science incentives into future funding-allocation strategies.

3.4 Conclusion

By drawing conclusions from the diversity of positions and national initiatives for Open Science we can see how important it is to work with modular approaches based on close monitoring and analysis of national contexts and research cultures. This chapter has provided the context of the MLE with regard to the European Open Science agenda. In a brief overview the current status of public discourse on altmetrics, potential scopes for incentives and rewards, as well as the status of Open Science implementation at the national level have all been discussed to enable the reader to correlate the countries' positions in the following chapter.

4 POSITIONS AND PERSPECTIVES FROM MEMBER STATES AND PARTICIPATING COUNTRIES

There is no well-established baseline for the implementation of Open Science. The goal of this MLE is to facilitate communication and reciprocal learning across and between countries and EU policymakers and Open Science experts. We started from the fact that countries vary considerably in their approach (or lack thereof) to Open Science, and we face huge differences in the velocities of uptake and mobilisation of relevant stakeholders. This is partly due to the very diversity in science policy and research governance among countries. This MLE turns this diversity into a virtue by facilitating learning from concrete experiences across Member States, thereby exchanging know-how and fostering understanding of the implications, advantages and disadvantages of different strategies to support and incentivise Open Science.

The MLE provided a rich environment for discussion and reflection of participating countries' status and strategies with regard to Open Science. This chapter is dedicated to the personal reflections from the country representatives who participated regularly and engaged in multiple discourses alongside building new relationships and fostering sustainable dialogue beyond national contexts. Throughout the exercise, participants were keen not only on learning from each other but also to support the successful transition towards Open Science and to develop convincing cases for change. Furthermore, in the following reflections, the status of Open Science will be summarised country by country, including outlooks on priorities, next steps and long-term aims.

4.1 Austria

"The sheer complexity of the change process towards Open Science is the biggest challenge for its implementation. The MLE was very useful for understanding the challenges but also learning and discussing solutions that other countries have experience with."

Dr **Michalis Tzatzanis** works at the Austrian Research Promotion Agency (FFG) as a National Contact Point for Horizon 2020. He coordinates the Open Science agendas inside the FFG's Division for European and International Programmes. He has holds a doctoral degree in ecology from the University of Vienna and a Master's of Science in Conservation from University College London.

Personal motivation and learnings from the MLE:

Open Science is high in the agenda towards FP9 and the accomplishment of ERA. The MLE provided me with an excellent opportunity to understand the most central challenge to the implementation of Open Science, namely: finding ways to break with the 'publish or perish' philosophy that ensues our current fixation to publication record and individual H-indexes for valuing and rewarding scientists and researchers.

The MLE's work made clear to me that altmetrics are not the solution but rather we need a multivariate set of process indicators, valuing Open Science practices in addition to mainstream scholarly outcome.

4.1.1 National context

Current status

Austria has a very active Open Science community, with the 'Vienna Principles' being its most prominent outcome.[54] However, at present there are no mandatory national policies for Open Science, even though 16 institutions have a registered Open Access policy and 25 institutions have signed the 'Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities'.

The Austrian Academic Library Consortium (KEMÖ) together with the Austrian Science Fund (FWF) have been pioneering actors in negotiating Open Access

[54] http://viennaprinciples.org/

contracts with publishing houses, and just recently, the first contract worldwide was signed making all costs, conditions and services fully transparent.[55]

The Austrian Science Fund (FWF) has a mandatory Open Access policy for publications, including monographs, which was assessed as one of the most effective policies of any funding agency worldwide.[56] That also includes a journal transition programme in 2012,[57] a pilot programme on Open Data in 2016[58] and Open Government policy that makes evaluations, statistics and similar materials openly accessible.[59]

The University of Vienna has led the way in Open Access practice and policy by also being a partner of OpenAIRE from day one.

In November 2017, there were 29 repositories for publications listed by OpenDOAR, 32 repositories for research data by re3data, and 41 Open Access journals by DOAJ.

OANA, the Austrian Network for Open Access, is an informal network of stakeholders pushing the Open Access and Open Science agendas in Austria. It comprises representatives of ministries, the rectors' conference, librarians, research organisations, funders and the Open Knowledge Foundations' work group on Open Science. The 'Recommendations for a transition to Open Access'[60] by OANA and the Rectors' Conference were acknowledged in the Council of Ministers in 2016.

The national Research and Technology Promotion Act (FTF-G) includes the legal standard for the evaluation criteria; the guidelines stipulate that "a written evaluation plan must be created for all subsidy programmes and measures based upon the ... RTI guidelines". The share of organisational funds in Austria that is allocated competitively has been increasing in recent years and will continue to do so. Programme and organisation evaluation reports must be accessible to the public, and published on the Austrian Platform for Research and Technology Evaluation's homepage.[61] To date, the evaluation criteria do not consider Open Science.

Project-based funding is mainly organised by the Austrian Science Fund (FWF) for fundamental research and the Austrian Research Promotion Agency FFG for applied research, by a competitive structure resting on (mostly international) peer review. Neither FWF nor FFG use metrics to decide on research projects

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[55] http://www.fwf.ac.at/en/news-and-media-relations/news/detail/nid/20171221-2274/

[56] https://doi.org/10.5281/zenodo.35616 and https://doi.org/10.5281/zenodo.815932

[57] https://doi.org/10.5281/zenodo.16462

[58] https://doi.org/10.5281/zenodo.803234

[59] https://zenodo.org/communities/fwf/?page=1&size=20

[60] https://doi.org/10.5281/zenodo.51799

[61] http://www.fteval.at

but the FWF is asking for minimal conditions for the track record. The FWF has funded the publications' costs of Open Access since 2001, developed a policy in 2004 and mandated Open Access to scholarly publications since 2008. As a result, in 2016, 92 % of all peer-reviewed publications listed in final reports of FWF-funded projects were Open Access.[62]

Austria has not yet used altmetrics for research assessment, but the FWF has published two pilot studies on their feasibility.[63]

Currently, there are several important projects focusing on various aspects of Open Science, such as:

- The funding pool (Hochschulraumstrukturmittel HRSM) of the Federal Ministry of Science, Research and the Economy is being used as seed funding for cooperation projects across Austrian universities, the goal being to promote lasting positive effects and importantly an increase in efficiency, supporting measures like the redesigning of licence agreements with publishers, as well as spurring researchers into publishing through Open Access agreements and encouraging new Open Access strategies for publications.

- The Austrian Transition to Open Access - AT2OA: its objectives are to monitor and assess the transition to and costs of the transition to Open Access, as well as developing various Open Access models, such as a publication fund.

- The 'e.Infrastructures plus' project aims to implement infrastructure for 'eScience' in seven work packages. The themes of those packages, which are being worked on, range from 'research lifecycle patterns' and 'institutional repositories' to 'DOI infrastructure'.

- Furthermore, the Open Educational Resources initiative, the Digital Humanities Austria platform and the Austrian Social Science Data Archive AUSSDA are fostering Open Science practices via training and infrastructures.

- The Citizen Science Network Austria (CSNA) currently includes 31 Austrian institutions which signed a Memorandum of Understanding on collaborating and fostering Citizen Science in their respective institutions and on the Citizen Science platform 'Österreich forscht' (www.citizen-science.at). The platform's 2017 annual report documents more than 100 000 citizen scientists involved in current projects.

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[62] https://doi.org/10.5281/zenodo.811924

[63] https://doi.org/10.5281/zenodo.28229 and http://scilog.fwf.ac.at/en/article/6883/alternative-science-metrics

Future steps and measures to be taken

- Austria urgently needs champions and role models!

  In order to propagate the 'cultural change' that Open Science implies, Austria needs to bring its prominent researchers and/or stakeholders from the OS research landscape into the spotlight to take up the role of 'OS champions', leading by example and showcasing the benefits of the new *modus operandi* for science.

- Initiate a process for a national Open Science policy/strategy

  Austria was the first Member State to adopt a national Open Innovation Strategy. The time has come to initiate a similar participatory process for a national Open Science Strategy. In this way, the different active initiatives in the fields of Open Access, Open Data and Open Science could be brought together under a common umbrella. Experiences from the Open Innovation Strategy consultation should be used.

  A role model could be the Netherlands' national Open Science plan[64]

- Use the ERA Roadmap structures as a vehicle

  Austria has a very-well-defined structure for achieving the ERA Roadmap objectives and has compiled a comprehensive national ERA Roadmap. The existing structures could and should be used as a vehicle to initiate the process towards a national Open Science Strategy, since the objectives of Open Science and ERA overlap considerably.

- Bring Open Science to the negotiation of performance contracts with universities

  Along with the research funders, universities have a huge role to play in a future Open Science Strategy. The competent federal ministry should use the opportunity provided by the ongoing negotiations in the new round of performance contracts (*Leistungsvereinbarungen*) to motivate universities to adopt evaluation procedures that incentivise and award Open Science practices. Infrastructures and support services for Open Access and Open Research data should be promoted.

For further information on the Austrian situation and plans, please contact Mr Thomas Lichtenwöhrer at Thomas.Lichtenwoehrer@bmbwf.gv.at and/or Ms Kerstin Zimmermann at Kerstin.Zimmermann@bmvit.gv.at.

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[64] https://www.openscience.nl/binaries/content/assets/subsites-evenementen/open-science/national_plan_open_science_the_netherlands_february_2017_en_.pdf

4.1.2 Important links

- OANA: http://www.oana.at/en/home/
- Open Innovation Strategy: http://openinnovation.gv.at/
- FWF OA policy: https://www.fwf.ac.at/en/research-funding/open-access-policy/
- Austrian Platform for Research and Technology Evaluation: http://www.fteval.at
- eInfrastrucutres Austria PLUS: https://www.e-infrastructures.at/en/home/
- Digital Humanities Austria: http://digital-humanities.at/en
- Open Education Austria: http://www.openeducation.at/en/home/
- The Austrian Social Science Data Archive: https://aussda.at/en/

4.2 Bulgaria

"We need to work together for a global application of the Open Science policy, so as to achieve the added value for Europe and beyond. At the same time, cyber security is an issue to be observed and treated carefully."

Prof. **Ivan Dimov** is currently a deputy-minister of education and science. He is a member of a national working group for developing a national vision for Open Science policy implementation.

Personal motivation and learnings from the MLE:

As a member of a national working group for developing a national vision for Open Science policy implementation, I am very interested in the MLE altmetrics discussions. On the other hand, my current responsibility is to carry out the national monitoring and evaluation system for the research performance of the HEIs and ROs. The system is to be updated and this mutual learning exercise gives me the opportunity to understand about the other Member States' systems of evaluation and different models applied. Altmetrics are metrics for future application in Bulgaria and will only be complementary to traditional, citation-based metrics.

4.2.1 National context

Current status

Bulgaria has been active in making Open Access a reality for the research system. An academic team was working together with the Ministry of Education and Science on a policy for Open Science and Open Research Data. Open Science measures are foreseen to be implemented in the government's National Strategy for Development of the Scientific Research 2017-2030 and National Roadmap for Research Infrastructure 2017-2023 which have already been adopted. The Ministry of Education and Science is the main coordinator and hub for all Open Science activities in the country. The main activities laid down are:

- Development of the 'Bulgarian linked open data' through greater participation in Wikidata, DBpedia, GeoNames and others, which will increase access to information for consumers via the web.

- Providing Open Access to scientific results and to big databases and genetic resources by creating e-platforms will reflect on the results of the infrastructure activity.

- Support for the National Centre for high performance and distributed computing is an electronic infrastructure that integrates computing systems and data storage, software, middleware and services, and offers Bulgarian researchers a transparent and Open Access for the development and operation of computing-intensive scientific applications participating in PRACE ESFRI project.

- Support for the National Infrastructure for Research and Innovation in Agriculture and Food – (RINA, Research, Innovation and Agriculture) is a new infrastructure which will update the existing scientific and servicing units and will put them together in five research complexes in the main thematic areas of agricultural science.

- Participation in the EU initiative 'European cloud for open science'.

Some of the main activities in Bulgaria concerning Open Science, Open Data, and Open Access during the last year include:

- Maintaining the National Open Access Desks which connect researchers, research institutions, and policymakers at the national level on one side, and the OpenAIRE 2020 project services on the other.[65] The focus of the Desks' activities is on support for compliance with EU Open Access policies;

- Maintaining the Bulgarian repositories for Open Access;

- Developing a policy vision for the development of Open Access and Open Data, presented to the EC.

Bulgaria is part of the EU OpenAIRE2020 project. The main project dissemination results include: promoting the open availability of publications and data and participation in scientific conferences in Bulgaria.

Bulgaria is also part of the ERAC Standing Working Group (SWG) on Open Science and Innovation, and the Ministry of Education of Science acknowledges and shares the challenges being discussed.

The national annual information day on Open Access to scientific information invites: 1) representatives of national institutions (including the Ministry of Education and Science, Ministry of Transport, Information Technologies and Communication and Ministry of Culture) responsible for the development of Open Access policies; and 2) representatives of Bulgarian institutions (research institutes and universities) active in the implementation of Open Access policies and programmes. The national information day covers activities such as:

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[65] http://www.mon.bg/?go=page&pageId=4&subpageId=54; http://www.bg-openaire.eu/; http://eprints.nbu.bg/

- Open Science
- Evaluation in an Open Science context
- Copyright retention
- Acknowledging, improving and valuing the existing European Open Science infrastructure
- Open Innovation
- Cross-cutting issues
- The main results of the workshop were: Workshop participants learned the main concepts for the implementation of Open Access principles and the national Open Access roadmap, key terms, strategies, business models, work plans, copyright and licences, best practices, examples and policies for Open Access, Open Data and Open Science. The academic staff (young and experienced researchers) and research project managers practised Open Access and acquired knowledge and skills on how to write, publish and deposit articles, scientific data and materials in Open Access repositories, maintaining these repositories, etc. The policymakers and staff working in funding bodies acquired practical skills on writing Open Access policies, strategies and plans.

In 2015, the Bulgarian government adopted regulations for monitoring and assessing the research performance of HEIs and PROs. A commission of 13 independent experts appointed by the Minister of Education and Science are responsible for the annual evaluation of research performance of all these institutions. After the pilot evaluation in 2017, an update of the Regulation has been undertaken and the set of criteria elaborated based on three groups of metrics: publications, normalised field-weighted citation impact, and information on the socio-economic value of research.

Currently there are no altmetrics based research assessments or tests running in Bulgaria. However, there is interest in learning from others on their use, and their validity and to use new responsible metrics to support the decision of the distribution of research funding.

Currently, no specific rewards or incentives for practising Open Science are being implemented.

In November 2017, 10 Open Access repositories were listed in OpenDOAR, with the emphasis on medicine and mathematics, besides multidisciplinary foci, all of them linked to HEI institutions.

OS is part of the national strategy mentioned previously. Its implementation considers the following steps in the short term: establish National Open Access Desks which connect researchers, research institutions, and policymakers at a national level on one side, and the OpenAIRE project services on the other. The

focus of the Desks' activities is on support for compliance with the EC Open Access policies. Maintain and further develop the Bulgarian repositories for Open Access; organise related conferences, workshops and seminars for researchers and science administrators; develop a policy vision for the development of Open Data.

Open Access publication is an eligible cost for HEIs' research activities (under the Regulation of the Council of Ministers for monitoring and differentiated funding of research performance in the state universities) and for the ESIF Operational Programme for Research and Education for Smart Growth research centres.

Future steps and measures to be taken

The Bulgarian Ministry of Education and Science and its stakeholders will now design the national programmes, one of which is focused on ICT in favour of education and research. The main objective of the programme is to foster open research and innovation policy.

For further information on the Bulgarian situation and plans, please contact Ivan Dimov (i.dimov@mon.bg) and Yani Zherkova (yanitazee@gmail.com).

4.3 Belgium

Eric Laureys: *"Open Access advocates are first and foremost promoters of civil society."*

Marc Vanholsbeeck: *"There will not be any serious change towards Open Science and alternative ways to produce, disseminate and make accessible the whole spectrum of research outputs without substantive changes in the way we assess research and researchers."*

Bart Dumolyn: *"Open Science is more than Open Access and Open Data; it is a way of looking at the world, with the intent of building a better society."*

Eric Laureys (right): Advisor at the Coordination Department of the Belgian Federal Science Policy Office (BELSPO); Federal Open Access Repository Administrator; coordinator of the Belgian Commission for Federal and International Open Science Cooperation; coordinator of the Open Science Strategy Group of the Federal Administration.

Marc Vanholsbeeck (left): Responsible of the Direction of Scientific Research of the Ministry of the Wallonia-Brussels Federation (MWBF); in charge of Open Science-related matters at MWBF; vice-chair of the European Research Area Standing Working Group on Open Science and Innovation.

Bart Dumolyn (middle): Policy advisor on Open Science and Responsible Research and Innovation for the Flemish Government; chair of the Flemish Europa Platform Working Group on Open Science and Open Innovation.

Personal motivations and learnings from the MLE:

Eric Laureys: Sharing best practices, deepening knowledge, networking and multiplying information channels.

Marc Vanholsbeeck: Better understanding of how the host countries articulate the issue of rewards with other Open Science topics. In particular, I found it illuminating to have different kinds of stakeholders present, and to understand better how the process of getting an agreed Open Science roadmap is made possible at the national level. The MLE confirmed my belief that Open Science is a twofold phenomenon. The Open Science of the Big Deals 2.0 is foremost a business model issue, but there is a more radical Open Science (Open Data, alternative publishing platforms, Citizen Science, etc.) that deeply challenges the traditional academic (reputation) economy.

Bart Dumolyn: It was particularly interesting seeing the different approaches. Examples such as Switzerland were fundamentally inspirational since Switzerland shares with Belgium a complex policy field with various federated entities. We live to learn.

4.3.1 National context

Current status

The 2012 Brussels Declaration on Open Access, signed by the federal, Flemish and Brussels-Wallonia Federation of Science Ministers, commits the signatories to "investigating possibilities and new opportunities in the broad Open Access field, all in frequent collaboration with relevant stakeholders, considering Open Access to scientific publications a forerunner of new initiatives in the 'Open Data' and 'Open Science' areas". As regards those topics, there have been many information activities since then which have been organised at the institutional level by research performing organisations (RPO) and academic libraries themselves.

Actors

Governance of the Belgian research system reflects the country's federal structure. There are three main government funders in Belgium: F.R.S-FNRS funds French-language university basic research; The Research Foundation Flanders - FWO funds Dutch-language university research; and the Federal Belgian Science Policy Office funds research everywhere but has actual adminstrative competence over 10 federal research institutions.

Research evaluation and altmetrics, rewards and incentives

Research evaluation is carried out for certain scientific programmes only by a scientific committee.

At the institutional level, committees in charge of recruitment and career promotion assess scholars' research abilities together with their teaching capacities, according to rules agreed at the local level. In Flanders, ECOOM contributes to provide performance indicators (particularly in the social science and humanities SSH) for the university research funding in Flanders 'BOF funding' (special research funding outside of the main Flemish RPO funder which is FWO).

There is no centralised way to fund research on the basis of performance. However, bibliometric analysis is part of research organisations' and projects funding at all levels. Research funders have not yet implemented an Open Research Data strategy, even though preserving and providing access to data to allow verification of published research is addressed in the 'Code of Ethics for Scientific Research in Belgium'.

To allow evaluators to base/complement their assessment on a diversity of performance indicators, most Green Open Access repositories (e.g. Orbi for the University of Liège) have chosen to make a broad set of metrics and altmetrics available through the repository. Also, the F.R.S.-FNRS leaves some freedom to the researcher to refer to those metrics they find interesting/advantageous to mention in their applications.

Universitites were the first to adopt Open Access mandates, following the trend launched by the University of Liège and its "Immediate-Deposit & Optional-Access" IDOA approach. At the University of Liège, only what has been archived in the Green Open Access repository ('ORBI') counts in the evaluation (= the 'Liège Model'), a method that has now been adopted by numerous French and Flemish universities as well as the federal RPO.

National planning

A recent example of the harmonisation of efforts between regional and federal authorities was the drafting of the ERA OS Roadmap, from which the following common priorities could be distilled:

- Monitor and study the costs of gold Open Access, taking into account existing alternatives to the article processing charges (APC) business models, such as Diamond Open Access journals, so called 'epi-journals', dissemination and review platforms, or any 'out-of-the-box' business models.

- Coordinate efforts to implement 1-year/6-month embargoes at national level.

- Work towards national repository compatibility and harvesting capacity, taking into account the context of the pending legal depot law with regard to digital publications.

- Explore matching copyright regulations in fields such as:

  - Secondary publication rights (inspired by the German model)

  - Text and data-mining exceptions.

- Develop compatible or even common Open Data policies (with mandatory data management plans) and explore opportunities to develop Open Data repositories and/or data centres at national and/or regional level.

- Consider Open Science practices (such as data sharing or Open Access publication) for positive research and researcher evaluation.

- Should the federal level choose to make its research open, it could do so, based on the above-mentioned legal framework. Starting in 2018, a mandate furthering deposit will no longer be needed.

- The link between Open Science and Open Education should be investigated, in particular for the development of altmetrics able to track the use of research within (open) educational research.

Achievements: infrastructure

The Open Access Belgium website documents Open Access/Open Science-related activities in Belgium.[66]

The Federal Science Policy Office (BELSPO) central Orfeo OA repository serves 13 federal research and supporting institutions.[67] Three federal research institutions have their own OA repositories.

On 8 December 2017, the Wallonia-Brussels Federation launched an Open Access repository intended to archive and make accessible the 'grey literature' that results form research sponsored by the ministry or conducted by its observatories.[68]

At the regional level, universities and research institutions boast 24 Open Access repositories as listed by OpenDOAR and 28 Open Research Data repositories as listed by re3data.org in November 2017.

Achievements: policies

A federal law for secondary publication will be enacted in 2018.

A federal law mandating the deposit of online publications in the national legal depot is also due to be enacted in the first half of 2018.

A federal royal decree will cede federal researchers' publication rights to the state early in 2018.

A regional draft decree of the Wallonia-Brussels Federation will mandate Green Open Access in 2018 for all publicly funded research in the region, building on the Open Access mandate of the University of Liège (2007) and the Open Access regulations of the F.R.S.-FNRS funding agency (2013): immediate deposit, optional access; evaluation of researchers on the basis of what has been reposited with full text only.

ROARMAP lists 20 Open Access mandates in Belgium, either at the funder or institutional level. The comprehensive federal BELSPO mandate was adopted on 21 December 2017. The two regional funders' Open Access mandates can be

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[66] https://openaccess.be/

[67] https://orfeo.kbr.be

[68] http://www.webopac.cfwb.be/recherches/home

found on SHERPA/JULIET (FNRS and FWO). All Belgian universities have recommendations in place requiring or requesting them to make their research publications Open Access when archived, although with different levels of achievement/coercion.

Achievements: framework and awareness raising

National consultation takes place in the Commission for Federal Cooperation.

DMPBelgium, a member of DMP Online, is a bottom-up initiative bringing together stakeholders from both the federal and regional levels for a consensual approach to ORD stewardship. All Belgian French-speaking universities take part in the initiative.

Universities of both linguistic regions jointly organise a yearly Open Access conference during Open Access week. At the insitutional level, a lot of Open-Science-related activities are organised, including workshops for targeted audiences and surveys on researchers' attitudes and perceptions.

National Open Access Desk NOAD service has been set up in the University of Ghent's library.

BELSPO has set up an Open Access Helpdesk and a yearly training session for institutional Open Access contacts.

BELSPO coordinates the Federal Open Science Strategy Committee.

The Flemish Region organises a yearly Open Science Forum and has established a systematic stakeholder consultation on the topic through a dedicated Working Group on Open Science and Open Innovation (mirroring the ERAC group). A 'Flemish ERA Roadmap' was created with an Open Access chapter, and was later merged into the Belgian Roadmap, which serves as a guideline for further policy initiatives in Flanders.

Future steps and measures to be taken

Intentions: infrastructure

The Flemish region is considering creating a central Open Research Data repository. Discussions with the RPO and the RFO are ongoing.

Under the auspices of the F.R.S.-FNRS (funding agency of the Wallonia-Brussels Federation), work started on the development of a portal allowing harvesting from existing Open Access repositories in French-speaking universities.

Intentions: policy

The federal authority will create a working group to define its Open Research Data policy.

The Flemish Council for Science and Innovation has issued a list of recommendations regarding Open Science. The VLIR (Flemish Inter University Council) has published a document with policy recommendations on Open Science. A specific Working Group on Open Science and Open Innovation under the umbrella of the Europa Platform, the systematic stakeholder interaction forum between the Flemish Authorities and their stakeholders (in that case mostly the Flemish RPOs), has been established to further develop the Flemish Open Science policy.

For further information on the Belgian situation and plans, please contact Bart Dumolyn (bart.dumolyn@ewi.vlaanderen.be) (Flemish Open Science policies), Eric Laureys (Eric.LAUREYS@stis.belspo.be) (Federal Open Science policies), and Marc Vanholsbeeck (marc.vanholsbeeck@cfwb.be) (Wallonia-Brussels Federation Open Science policies).

4.4 Croatia

"There's no 'one-size-fits-all' model for implementing Open Science in all EU Member States. However, many Member States are facing similar challenges and dealing with them using a slightly different approach. This MLE was a great opportunity to get a good overview of best practices and adopt some of them to our country needs."

Bojan Macan, PhD, currently works as a head of the Centre for Scientific Information at the Ruđer Bošković Institute, Zagreb, Croatia. His interests are related to research evaluation and Open Science. He is/was engaged with several international projects dealing with Open Science (OpenAIRE projects, FOSTER), as well as with projects and initiatives on developing information systems at the national level, such as CROSBI, DABAR and FULIR.

Personal motivation and learnings from the MLE :

This MLE gave me the opportunity to learn more about different ways in which other Member States are dealing with similar challenges as Croatia. Although there isn't a single model used in other Member States which could be applicable to other countries, there are a number of good ideas and initiatives in almost every country which could easily be adopted and implemented by other Member States. This exchange of experience and ideas is one of the main benefits of this MLE.

4.4.1 National context

Current status

Croatia has a strong performance-based funding model. The model for public R&D funding focuses on awarding multi-annual block grants for HEIs and PROs from the state budget by the Ministry of Science and Education of the Republic of Croatia (MSE). The funding amounts are determined on the basis of annual institutional performance indicators, taking into account research productivity (weight 60 %), national and international competitive research projects (weight 30 %) and research mobility and collaboration between research and the business sector, as well as collaboration with the units of local and regional governance and the non-governmental sector (weight 10 %). Funding of scientific, higher education and technological programmes and projects in Croatia is done through the Croatian Science Foundation (CSF) which was established by the Croatian Parliament in December 2001. The mission of the CSF is to promote science, higher education and technological development in Croatia in order to ensure the development of the economy and to support employment. Besides funding scientific projects and programmes, the CSF is also fostering international cooperation and helping to achieve scientific

programmes of special interest in the field of fundamental, applied and developmental research.

National policies on access and preservation of scientific information (both publications and research data) are the responsibility of the MSE. The ministry strongly supports Open Access to scientific information to provide maximum impact from the research its supports. The Croatian Research and Innovation Infrastructures Roadmap 2014-2020 addresses the promotion of Open Access to scientific papers and research data, especially those funded from public sources. No comprehensive national policy is yet in place, but there is much ongoing work in this area.

Croatian Law on Science and Higher Education mandates that all higher education theses should be available in Open Access in a corresponding university library repository. At the national level, a similar mandate for other types of publications does not exist yet, although there are a few institutional mandates, such as those on the Ruđer Bošković Institute (RBI), University of Zagreb, University Computing Centre (Srce), Faculty of Mechanical Engineering and Naval Architecture of the University of Zagreb, and the Physics Department of the Faculty of Science at the University of Zagreb. The RBI is incentivising Open Access as one of the criteria for the awards for the best scientific papers in a given year on the basis that these works are stored in the FULIR institutional repository. The CSF, the biggest national scientific projects funder, has not yet adopted any Open Science requirements or provisions, besides recommending Open Access for funded research.

In Croatia, the current promotion regulations and hiring strategies in research and higher education in general favour scientific papers published in journals covered by the Web of Science Core Collection and Scopus. The greatest emphasis is still on 'high journal impact factor' publications, and no Open Science incentives and rewards are currently being implemented.

There is no single organisation that acts as the main coordinator or pusher of Open Science implementation and monitoring, although part of the research community (primarily Ruđer Bošković Institute and Srce) invests significant resources in this area. Open Access in Croatia has a long history, starting with a Croatian Scientific Bibliography – CROSBI,[69] a national bibliography of scholarly publications, which was established in 1997 and has enabled Open Access repository functionalities since its very beginning. In 2012, a number of actors signed the Croatian Open Access Declaration which clearly states that: "results of the activities financed by public funds, especially in the field of education and science, should be made available in Open Access". There is strong development of Open Access infrastructures and a vibrant Open Access journal publishing environment in Croatia, as well as platforms to increase the awareness of Croatian publications, such as the central portal of Croatian Open Access journals, called HRČAK,[70] which offers Open Access to more than 450

[69] https://www.bib.irb.hr/

[70] http://hrcak.srce.hr/?lang=en

journals. In January 2018, OpenDOAR listed 39 Open Access repositories, the majority of which are published through the newly developed national repository platform called Digital Academic Archives and Repositories – DABAR.[71] DABAR was developed through the collaboration of many Croatian academic institutions led by five partner organisations – the RBI and Srce as well as the School of Medicine and Faculty of Humanities and Social Sciences (both part of the University of Zagreb) and the National and University Library Zagreb.

Croatian stakeholders have been experimenting with altmetrics. Ruđer Bošković Institute uses altmetrics together with bibliometric indicators in its information systems – CROSBI and FULIR,[72] while the repository of the Croatian Open Access journals HRČAK displays usage statistics (views and downloads). However, they are not used for evaluation.

Future steps and measures to be taken

In an environment where there is very low investment in R&D, lack of consistency in policy implementation (due to unstable political situations) and many issues from the past that must be addressed, it is difficult to work on system development and Open Science policy implementation as such. Only by integrating Open Science policy into other policies, such as ERA, is there any real possibility of it being both implemented and widely accepted.

Since Croatia is a small country, national coordination of Open Science activities is probably the way to go. So far, Croatia has been missing top-down initiatives since everything that happened was bottom-up. Open Science needs to be further included in scientific advancement and/or research grant funding where a CSF also has a big role. However, parallel and intensive Open Science education and training are crucial because of the false perception of Open Science and related topics among researchers and policymakers.

Since the evaluation system in every country has a crucial role to play in changing researchers' habits, the Croatian evaluation system needs to change. The current evaluation system favours publications in high-impact-factor journals, which is a direct disincentive for using Open Access repositories. In addition, a national Open Access repositories infrastructure needs to develop further, especially to enable research data archiving and preservation.

For further information on the Croatian situation and plans, please contact Bojan Macan at Bojan.Macan@irb.hr.

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[71] https://dabar.srce.hr/en

[72] http://fulir.irb.hr/

4.4.2 Important links

- Croatian Research and Innovation Infrastructures Roadmap 2014-2020 (2014): https://mzo.hr/sites/default/files/migrated/croatian_research_and_innovation_infrastructures_roadmap.pdf

- Croatian Open Access Declaration (2012):https://www.fer.unizg.hr/oa2012/declaration

4.5 France

"It was important for us to exchange with colleagues from other countries on policies to promote Open Science, as it is indeed rather new and it raises challenges, especially for implementing such policies. We saw that there are numerous initiatives in this area and ministries have a role to accompany those initiatives and identify measures that could be taken at a wider scale."

Marie-Pascale Lisée works for the Ministry of Higher Education, Research and Innovation in the unit in charge of scientific information, thus dealing with scientific libraries as well as Open Access policies. She is the delegate for France in the ERAC SWG on Open Science and Innovation.

Pierre Mounier is associate director of the Center for open electronic publishing (Cléo) and a member of scientific committees on several Open Access edition structures. He also teaches and has co-created a course on digital humanities in École des Hautes Études en Sciences Sociales EHESS.

Emmanuel Pasco-Viel works for the Ministry of Higher Education, Research and Innovation in the unit in charge of ERA and EHEA strategies. He deals with ERA topics, among other Open Science issues. For example, he was in charge of coordinating the French positions on the Council Conclusions on Open Science adopted under the Dutch presidency.

4.5.1 National context

Current status

France has played an important role in the European Open Access movement, particularly in the launch of the Berlin declaration that was co-developed by the Max Planck Society and the CNRS.

In France, several types of entities are involved in Open Science initiatives:

- the Ministry for Higher Education, Research and Innovation
- our main funding agency (ANR)
- higher education and research institutions (universities and PROs)
- other ministries, such as the Ministry in charge of Industry

Through the ANR call for proposals, projects are selected based on their scientific quality, as well as on their economic relevance for industries, where applicable. In November 2007, the ANR issued an Open Access policy, strongly encouraging the deposit of funded publications in open archive systems and in HAL (Hyper Articles en Ligne – one of the main Open Access archives) in

particular. It is worth noting that the humanities and social sciences department has adopted a stronger policy mandating the systematic deposit of publications in HAL-SHS.

Main policy initiatives or legislation related to open data

Policy initiatives are currently under way concerning underlying infrastructures for Open Data and sharing scientific results. The research infrastructure roadmap includes data management plans and respect of international Open Data standards. Open Data is being promoted during the ongoing preparation of the 2018 update of the French national roadmap for research infrastructures. A second initiative concerns the development of a national digital strategy that encompasses Open Access, Open Courseware, Open Public Data and the underlying data infrastructures needed to accomplish these.

France participates actively in the development of European and global Open Science data policies. We contribute, through the EU group e-IRG and the EU-funded global alliance RDA, to working groups that are currently developing new standards and modalities for e-infrastructure commons, and the promotion of Open Science in general.

France is a founding member of GO FAIR, which will develop interoperability and data structuration recommendations.

Many research organisations have defined strategies to promote Open Research Data, and have developed policies and measures for Open Access to research data, including pilot programmes, such as:

- INRA (in the area of agricultural sciences) which is developing an approach to make digital scientific information accessible and usable, whether it is a publication or data from research projects.[73]

- CIRAD and IRSTEA (in the area of environment and agriculture) propose research data management to ensure sustainability, accessibility and reuse of the data.[74]

- The CNRS Institute for Scientific and Technical Information (INIST) has launched the online service DMP OPIDoR[75] to help research scientists and operators to set up data management plans. Open Data and Open Access are also disseminated to librarians and archivists.

An array of these research infrastructures has pioneered Open Research Data for specific scientific communities, e.g. the Centre de Données astronomiques

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[73] http://2025.inra.fr/openscience/CONTEXTE-ET-VISION

[74] http://www.cirad.fr/nos-recherches/ressources-et-infrastructures-de-recherche-ouvertes; http://www.irstea.fr/la-recherche/information-scientifique-et-technique

[75] http://dmp.opidor.fr

de Strasbourg (CDS)[76] for astronomy since 1972, Huma-Num[77] for digital humanities, and several projects in earth sciences, health, etc. Many of these infrastructures are French nodes of ESFRI research infrastructures and are often involved in the Research Data Alliance interoperability activities.

Furthermore, the French law for a digital Republic, promulgated on 7 October 2016, organises Open Access to scientific publications financed from public funds, giving authors of scientific writing the possibility to deposit their texts (in their accepted version for publication) on Open Access platforms after short deadlines of 6 and 12 months depending on the discipline. The law is superior to publishers' contracts, regardless of copyright clauses. This law is an important incentive for researchers to deposit their publications in repositories.

The Law for a digital Republic defines a framework for research access to confidential public data (personal data, professional secrets, etc.) and will probably be an important incentive to Open Data.

Text and data mining TDM is a topic of large-scale importance in France. The digital law includes an article on the ability to freely conduct TDM operations. The best way to implement this law is currently being debated.

Most of the institutions request better international alignment for policies as well as for some items such as length of embargos, types of licences, and the negotiation of better conditions for reusing content from Open Access repositories. The question concerning the APC is a major point: transparent publishers' costs; what services are covered by APC; and a common stand on reducing publishers' subscription fees in return for Open Access articles.

A large majority of organisations have signed up to or issued public statements and declarations regarding Open Access.

The majority of organisations indicated that they have a formal Open Access policy. In most cases, this mandatory policy applies to depositing or self-archiving the final accepted versions of papers, resulting from projects funded entirely or partly by the organisations.

The implementation of Open Access covers different national infrastructures, the major ones being:

- HAL, the national open archive platform, transdisciplinary, interoperable with local platforms and international thematic archives, such as Arxiv or PubMed Central, which receives more than 4 000 documents per month (48 000 in 2016) and hosts more than 80 institutional scientific archives. HAL is interoperable with major international repositories, such as ArXiv

[76] http://cdsweb.u-strasbg.fr

[77] http://www.huma-num.fr

- OpenEdition, national platform of books and journals in the platinum mode, which publishes more than 450 journals in social sciences and humanities, 4 000 books as well as 2 000 research blogs

- Persée, free access portal of retrospective collections in social sciences and humanities

- CINES, perennial archive warehouse for all the platforms and, in future, for research data.

Besides national repositories, some universities and research centres have their own repository.

Thus, we are encountering some difficulties regarding an Open Science policymaking, implementing or monitoring:

French research is composed of a very large number of research institutions, universities and research organisations; the dialogue between ministries and the scientific community is absolutely necessary to implement a national policy and makes tools sharing, management and monitoring of priorities essential.

France considers some topics in Open Science are very useful:

The evaluation of research, altmetrics, economic models with publishers, new metrics and indicators, are very important topics.

Some other questions are also important:

- How to reconcile practices and national legislation with European recommendations and directives

- How to strengthen synergies between national priorities and European priorities, in particular with regard to financing

- How to integrate concretely within the framework of these same European recommendations, especially within the framework of European projects

- Which axes of mutualisation relating to publications and data would be relevant to put in place at the European level: tools, practices, legislation, consortiums, etc.

- Which European strategy to promote exchanges and interoperability between Member States, and internationally, to avoid the risk that, one by one, national policies would block the implementation of this policy.

In July 2017, an Open Science advisor to the general director of research at the Ministry of Higher Education, Research and Innovation was nominated and is working with several units in the ministry on a national plan for Open Science.

In France, the status and maturity of Open Science varies according to disciplines, stakeholders, organisations and institutions. Yet, much more needs to be done to make Open Science the principle and default practice. Open Science is a model that promotes the European Commission and is developing globally: France is actively participating in it, too.

Priorities for 2018

- Make a state-of-the-art national and international ecosystem of Open Science: researchers, laboratories, organisations, funding agencies, infrastructure research, associations, publishers, etc.

- Support the transition to Open Science, in the context of developing the most economic balance and ethics

- Propose a position for a clear and strong France

- Propose a national roadmap – and the actions and means necessary to implement this road map.

In April 2018, the French government issued a national action plan for a transparent and collaborative public action 2018-20, called "Open Government and Parliament". Among the 21 commitments, one is dealing with Open Science: Build an Open Science ecosystem. Moreover, a specific action plan on Open Science will be soon announced by the Minister for Higher Education, Research and Innovation.

4.5.2 Important links

https://www.etalab.gouv.fr/opengov-openparliament-les-plans-daction-du-gouvernement-et-de-lassemblee-nationale-pour-une-action-publique-transparente-et-collaborative-ont-ete-lances

For further information on the French situation and plans, please contact Marie-Pascale Lizée at marie-pascale.lizee@recherche.gouv.fr.

4.6 Latvia

"Open science is the opportunity for scientists to show their research to more people and find new collaborations with industry, science and society."

Dr.chem. **Kaspars Veldre**:

2014 - today: University of Latvia, researcher, specialisation in physical chemistry, chemical kinets, solid state chemistry, crystallography.

2016 - today: Ministry of Science and Education, IT service manager, administrator of national science research information system[78]

Dr.chem. **Dmitrijs Stepanovs**:

2016 - today Ministry of Education and Science, Department of Higher Education, Science and Innovations, Senior Expert for Science Policy Planning

2011 – today Latvian Institute of Organic Synthesis, researcher, specialisation in supramolecular chemistry, small molecule and macromolecular X-ray crystallography

Personal motivations and learnings from the MLE:

Open science is part of the science development model. Together with new forms of science evaluation (altmetrics and rewards) it is starting to affect and will continue to affect science development and research directions. Science funders (ministries and councils) have to collect enough relevant data to monitor science development and should be able to create a fair reward system.

4.6.1 National context

Current status

Although an Open Access policy at a regional or institutional level has not yet been adopted, active work on Open Access implementation is being carried out. Currently, Open Access policy development is mainly taking place bottom-up at the institutional level, which could be a blueprint for a national policy. An important step contributing to the Open Access and Open Science movement in Latvian society was the creation of National Open Access Desk web page[79] and

[78] https://sciencelatvia.lv/#/pub/home

[79] https://www.napd.lu.lv/

open e-course 'Open Science'.[80] As yet, there are no mandatory Open Access policies in place governing research data in Latvia.

Law on scientific activity,[81] Section 9. Transparency of Information regarding Scientific Research states that: 1) Information regarding scientific research financed from the state or local government budget shall be transparent; 2) An institution responsible for the performance of scientific research financed from the state budget or the budget of derived public persons, which has commissioned the research, shall ensure general access to research results; and 3) Access to information that is related to scientific research may be restricted in the cases specified by law.

Having taken part in the OpenAIRE project, the Library of the University of Latvia has started to promote and support the Open Access movement in Latvia. The Library has also started to distribute information about Open Access to the academic and research community and has become one of the main information centres and leaders in promoting and support of Open Access initiatives in Latvia, encouraging other academic institutions to participate in Open Access activities. Riga Technical University joined the discussions on institutional repositories, copyright policy and further dissemination of Open Access initiatives. By November 2017, three OA repositories were listed in OpenDOAR.

Funding for scientific work in Latvia is mainly granted based on competitive results,[82] also available in English, click on right side). National research programmse include:

- Base financing (calculated by formula, which includes performance-based approach)
- State research programmes (state commissions for the performance of scientific research)
- Fundamental and applied research (the main criterion for the allocation of a grant shall be the scientific merit of a project, and shall be implemented in the priority directions of science approved by the Cabinet)
- Market-oriented research (promoting the integration of science and manufacturing)

Bibliometric indicators inform the performance-based financing of research activities. The research funders in Latvia have no mandatory policy on Open Access to publications or data, but in order to gain more visibility of their work and to have more impact on international research, some scientific institutions

[80] https://estudijas.lu.lv/mod/page/view.php?id=277910

[81] https://likumi.lv/doc.php?id=107337

[82] https://likumi.lv/doc.php?id=262508

and researchers publish in Open Access journals and repositories. However, grant funding can be dedicated to Open Access costs.

Latvia has no experiences in using altmetrics for research assessment.

There are currently no specific incentives and rewards for Open Science. However, in recent years, there have been multiple events, workshops and conferences dealing with the topic, mainly organised bottom-up or with the help of EU projects such as FOSTER among others.

Future steps and measures to be taken

- Latvia sees the need to develop an national agenda for Open Science, but will need better coordination of current actors and a strong committment from universities/research institutions and government. Bringing the main stakeholders together will be the most important next step. Then, a communication strategy must be developed.

- Since the research communities are small and fragmented, there is also the need to use a national research infrastructure, like a data repository, created by Latvia's national library[83] or data aggregation in the national science research information system.

- A new regulation asking for mandatory data deposition and Open Access must be included in the law on scientific activity allowing for more detailed Cabinet regulation.

For further information on the Latvian situation and plans, please contact the Ministry of Science and Education at pasts@izm.gov.lv

4.6.2 Important Links

- https://www.napd.lu.lv/

- https://estudijas.lu.lv/mod/page/view.php?id=277910

- https://likumi.lv/doc.php?id=107337

- https://likumi.lv/doc.php?id=262508, also available in English, click on right side

- https://academia.lndb.lv/

[83] https://academia.lndb.lv/

4.7 Lithuania

Aušra Gribauskienė: *"Participation in the MLE provided a great opportunity to get a closer and deeper insight into the implementation of various practices of Open Science. The established contacts and information provided encouraged me to propose concrete measures to our leaders."*

Irmantas Pečiūra: *"Today, in the globalised world, with the advancement of technologies and intensifying cultural exchanges, the idea of Open Science is especially relevant. It creates preconditions for the universal integration of scientific achievements, which is essential for the progress of humanity. I am grateful to be a part of this process."*

Aušra Gribauskienė: Chief Officer of the Science Division of the Ministry of Education and Science of the Republic of Lithuania, is responsible for the topics on Open Access to scientific information and EU Open Science initiatives. She is the national representative in the EU Council ERAC Standing Working Group on Open Science and Innovation and the European Commission Group of National Points of Reference on Scientific Information.

Irmantas Pečiūra: Research policy analyst of the Science Policy and Assessment Unit at the Research Council of Lithuania, is responsible for the in-depth analysis of Council-implemented competitive research funding and activities based on Open Science policies. He is Lithuania's national representative of EU Open Science initiatives (European Commission Group of National Points of Reference on Scientific Information) and Science Europe Open Access to Scientific Publications working group.

Personal motivations and learning from the MLE:

Aušra Gribauskienė: This MLE was very useful for my work, in particular the possibility to have an in-depth exchange about practical issues and potential solutions. The organisers provided various examples of good practice that could also be applied in Lithuania. I am going to propose some concrete measures to our leaders.

I also appreciate the country visits with their very practical examples. It was very useful to get information how countries are solving the problems they are facing, and the solutions they use.

In addition, in autumn I had the opportunity to present some findings from the MLE on the Open Access Week conference at the Kaunas University of Technology (Lithuania).

Irmantas Pečiūra: Currently in Europe, there are many different formats of discussion about the Open Science policy and its development. However, this

MLE was the most interesting and useful I have been involved in. Its biggest advantage is that the gathered experts had the opportunity not just to report briefly on the current situation in their own countries, but also to learn from each other. This is particularly important for countries which are just preparing to take more active steps in this area. By learning from others we can avoid mistakes and implement necessary changes more smoothly and with greater efficiency.

4.7.1 National context

Current status

The Law on Higher Education and Research (2009, revised in 2015 and 2016) stipulates that "the results of all research works carried out in state higher education and research institutions must be communicated to the public". In February 2016, the Research Council of Lithuania (RCL) approved a set of 'Guidelines on Open Access to Scientific Publications and Data'. They include the statement: "to establish the transitional period for the implementation of the Guidelines by 31 December 2020". The RCL is monitoring the implementation of these guidelines. To date, there are no other mandatory institutional Open Science policies.

There is an Open Access National Desk, and the country's most active player in the dissemination of Open Access initiatives is the Lithuanian Research Libraries Consortium, which is a member of Electronic Information for Libraries EIFL. The Open Access ideas are supported by the RCL, the Lithuanian Ministry of Education and Science, the Lithuanian Academy of Sciences, the Association of Lithuanian Serials and other organisations. Various events (seminars, round-table discussions and presentations delivered by Open Access supporters at the national and international levels since 2005) have played an important role in advocating Open Access ideas in Lithuania. The Lithuanian National Commission for UNESCO invited stakeholders to focus on Open Access.

At the end of November 2017, OpenDOAR listed 11 repositories. Several repositories dedicated to research data are currently being developed, such as the Lithuanian Data Archive for HSS LiDA, and the National Open Access Research Data Archive (MIDAS). There are 32 Open Access journals listed in the Directory of Open Access Journals DOAJ.

The research activity of state HEIs is evaluated according to the higher education and research institutions' Research (Arts) Works Evaluation Methodology adopted by the order of the Minister of Education and Science. Evaluation coordinated by the Research Council of Lithuania is based on bibliometric informed peer review, including quantitative assessment of scientific publications and other research activities and output such as patents. Research projects are funded by the Research Council of Lithuania, based on a competitive funding scheme. Contract agreements with the RCL promote Open Access. Since 2017, project managers must submit data management plans with their project applications and, if their project wins, they have to submit a

detailed data management plan six months after the signature of the contract agreement.

All universities' academic libraries organise trainings on Open Access to research information. There are currently no specific rewards or incentives for Open Science. Although Lithuania is lacking prominent role models promoting Open Science ideas, its research institutions are trying to establish their own policies regarding Open Access and Open Science.

Future steps and measures to be taken

- Currently in Lithuania, there is no political unity regarding Open Science. For this reason, the development of such policies are facing a lot of challenges. However, in order to ensure the consistent and long-term achievement of Open Science objectives, the Ministry of Education and Science is looking forward to finding ways to integrate Open Science priorities into existing strategic documents.

- In 2018, a mid-term evaluation of the guidelines of Open Access to Scientific Publications and Data (published by Research Council of Lithuania) is planned. It is expected that a more detailed strategy and/or action plan will be developed in the context of the evaluation of these guidelines. It is also expected that new strategic documents will include incentives and rewards, altmetrics and other important aspects of Open Science policy.

- Lithuania is gradually looking for ways to integrate into the European Open Science Cloud (EOSC). At the moment, the country is monitoring the current situation in order to evaluate already existing e-infrastructures, and is expecting to create conditions for them to integrate into international infrastructures.

- Lithuania is looking forward to establishing a bottom-up approach for the development of Open Science policies. One of the country's main aims is to promote a human resources policy for the research institutions (recruitment and evaluation processes) by integrating aspects of Open Science.

For further information on the Lithuanian situation and plans, please contact Aušra Gribauskienė (aušra.gribauskiene@smm.lt), Ministry of Education and Science or Irmantas Pečiūra (irmantas.peciura@lmt.lt), Research Council of Lithuania.

4.7.2 Important links

- Research Council of Lithuania Resolution regarding the approval of the Guidelines on Open Access to Scientific Publications and Data:

  http://www.lmt.lt/data/public/uploads/2016/09/eng_-atvira-prieiga-_-galutinis.pdf

- Futher information about Open Science policy in Lithuania:

  http://www.lmt.lt/lt/mokslo-politika/atvirasis-mokslas/atviroji-prieiga/739

4.8 Moldova

"The MLE is the best opportunity to learn in real time about the different countries' experiences concerning science policies and to find more solutions for the same situation. Especially for Moldova, it means now to avoid difficulties and to catch the best practices in order to adapt it for the country's realities."

Aurelia Hanganu, Scientific Secretary General at the Academy of Sciences of Moldova, country responsible for developing science policies, and Moldova´s ERAC representative. Former head of the Central Scientific Library, former deputy director at the Institute of Linguistics. Doctor habilitatus in Romance and Latin Philology.

Personal motivation and learnings from the MLE:

For me personally, as a former head of the Central Scientific Library, this specific MLE was the opportunity to learn about Open Science and ways to promote the idea of Open Science in the academic community which, in the post-Soviet era, is a high closed community with strong respect for impact-factor publications. In my current position, as the person responsible for developing and promoting science policies, it was the chance to understand the problems that different countries faces with Open Science and the aspects that should be taken in account at all stages of developing and implementing Open Science policy.

4.8.1 National context

Current status

In the EU-Republic of Moldova Association agenda, there is a mid-term action about introducing an Open Science agenda to the Moldovan academic community. The government is in favour of an Open Science policy and faces the initial stage of conceptualising its implementation. The need to establish Open Science (OS) in the Republic of Moldova is determined by alignment with the ERA Roadmap.

In 2007, the Library Association of Moldova (LAM), in partnership with the Consortium of Electronic Resources for Moldova (REM), the Council of Rectors from Moldova, the Information Society Development Institute (IDSI), research institutes and universities, publishers of scholarly journals and researchers launched a national Open Access campaign to enhance access to scientific output, increase their visibility and amplify their impact.

OpenDOAR listed three repositories in November 2017.

Moldova's research evaluation is based on peer review and enforced regulation. There is a National Council for Attestation and Accreditation which is evaluating the research units in order to accredit them for scientific activity. It is the first institution in Moldova to introduce the mandatory requirement of Open Access for doctoral theses to be defended and has developed a repository of doctoral autoreferat published since 2004. Research proposal evaluation is conducted by the Agency for Research and Development, based on a competitive scheme. There are currently no dedicated mandatory policies for Open Access and Open Research Data, and furthermore there are currently no ambitions to experiment with altmetrics.

There are no incentives or rewards in place to support Open Science activities. The Institute for Development of Informational Society organises different events to inform about Open Science and to train researchers. It has created the National Bibliometric Instrument which is a repository of national scientific journals and is the result of a mandatory requirement for journals to be accredited as scientific journals. In addition, the librarian community is organising events about Open Access. Currently, the Moldovan Academy of Sciences is leading the promotion and implementation of Open Science. The State Agency for Intellectual Property has developed regulations, including recommendations for the implementation of Open Science.

Future steps and measures to be taken

- At present, a national strategy or policy recommendations for Open Science promotion and implementation are needed, because the separate actions being undertaken are not concerted.

- The ongoing reorganisation of the country's science system is establishing a leading role in developing science policies for the new Ministry of Education, Culture and Science. However, the Academy of Sciences' authority and performance, as well as the research institutes' experience must be taken onboard at least as regards developing the Open Science roadmap.

- Introducing Open-Science-dedicated financial resources is a demand of the national economical-financial strategy for 2019-2020.

- Introducing Open Science incentives and rewards are proposed by the new National Agency for Development and Research and the new National Agency for Quality Asurance in Education and Research (in the process of being organised).

- An integrated Open Science national information system should be developed as a single place where all information about scientific activity can be found; this is in line with the idea of centralising a scientific repository since the higher education and research institutions in Moldova are too many and too small to host their own repositories. The leading role of the

Information Society Development Institute IDSI, in collaboration with LAM and REM, is a key factor.

- It is necessary to inform and educate the research community in the use of altmetrics. Furthermore, altmetrics should be used in evaluation processes and considered as a factor for incentives and rewards.

For further information on the Republic of Moldova's situation and plans, please contact Aurelia Hanganu at aurelia.hanganu@asm.md.

4.8.2 Important links

- http://www.cnaa.md/theses/
- https://ibn.idsi.md/
- http://mf.gov.md/sites/default/files/documente%20relevante/pnaaa_2017-2019.pdf
- http://lex.justice.md/md/286236/

4.9 Portugal

"The MLE in itself is a praiseworthy example of how having an open approach, stimulating frank discussions, synergies and cross-fertilisation between interested parties can significantly advance knowledge on any issue. We need to fully embrace the cultural shift represented by Open Science and nurture it in all possible contexts."

Vasco Vaz and **Joelma Almeida** are science, technology and innovation officers at the Department for the Information Society – Fundação para a Ciência e a Tecnologia FCT. Their main duty is to develop Open Science strategy, to drive its implementation within the FCT and in coordination with other national and international stakeholders, and to promote Open Science practice awareness and uptake among the national research communities. Vasco is Portugal's National Point of Reference on Scientific Information before the European Commission and the national representative at the ERAC Standing Working Group on Open Science and Innovation, the FCT's representative in Science Europe's Working Group on Open Access to Publications, and rapporteur of the subgroup on Open Access and Open Data in the Interministerial Working Group to produce the National Policy for Open Science. Joelma is the deputy National Point of Reference on Scientific Information before the European Commission and is FCT's representative in Science Europe's Working Group on Research Data Management.

Personal motivations and learnings from the MLE:

Vasco Vaz: This MLE presented an excellent opportunity to interact with knowledgeable colleagues and experts on Open Science and research evaluation and to learn from the set of diverse challenges and related responses emanating from their particular contexts. The breadth and liveliness of the debates and the amount and quality of the knowledge produced, and translated in the exercise outputs, exceeded my expectations. Lessons on how to promote the active engagement of stakeholders in Open Science, as successfully pursued in partner countries, and on the different approaches to incentivising and rewarding Open Science will be particularly useful for Portugal.

Joelma Almeida: The MLE was an excellent opportunity to exchange ideas on an emergent paradigm of doing science with experts from different quarters. Country experiences to foster Open Science enriched this exercise by bringing out practices otherwise overlooked.

4.9.1 National context

Current status

The Open Science movement in Portugal dates back to 2003, when the first Open Access institutional repository was created in the University of Minho.

This initiative, along with activities from other institutions, strengthened the government's already existing interest in supporting the Open Access movement, which facilitated the creation of a national network of institutional repositories – the Repositório Científico de Acesso Aberto de Portugal (RCAAP) – through FCT (the major national research funder) funding.

All major Open Science activities in Portugal have since been underpinned by the RCAAP infrastructure, with a diverse range of services such as: providing Open Access to the journals and publications and data deposited across the entire network via a single point of entry search portal; hosting and technical support to Diamond Open Access journals from applicant academic publishers; supporting current research information systems by providing all types of information (publications, funding references, etc.) to interested parties (institutions, funders, authors); full integration and findability of the aggregated resources with the OpenAIRE infrastructure and the Brazilian aggregator OASIS; central hosting of Open Access repositories from applicant institutions; aggregation of locally hosted Open Access repositories; hosting of a pilot repository for Open Data sets; Open Science training, advocacy and awareness raising.

Currently, all public HEIs, including research units, and a significant number of private HEIs have a repository aggregated in RCAAP to provide Open Access to their research.

A significant number of institutions also have an Open Access policy in place.

At the same time, FCT has a mandatory Open Access policy which requires publications resulting from its funding to be deposited in RCAAP and be made Open Access, preferably at the time of publication. It also has a non-mandatory policy on the management and sharing of data. Both policies date back to 2014. Two major private research funders have also developed their own Open Access policies.

The Decree-Law 115/2013, published in 2013, mandates the legal deposit of a digital copy of every national Master's degree dissertation and doctoral theses in one of RCAAP's network repositories with the aim of providing for Open Access to and long-term preservation of scientific information. Every HEI is now legally obliged to comply with this requirement in relation to the dissertations and theses they issue.

OpenDOAR lists 56 Open Access repositories, and ROARmap lists 26 OA institutional policies.

The Ministry of Science, Technology and Higher Education has been setting the agenda on Open Science since it defined the topic as a research policy priority. There is an ongoing process to develop a National Open Science Policy, based on the statement that 'knowledge belongs to all and is for all'. To that effect, the ministry established an Interministerial Working Group with four specific topic focuses: Open Access and Open Data; infrastructures and digital preservation; scientific evaluation; and scientific social responsibility. The Working Group has diagnosed the current state of Open Science in Portugal and produced recommendations to include in the future policy document.

A number of other initiatives have been triggered by the government's action in cooperation with FCT, RCAAP and HEIs, such as: creation of the national portal, www.ciencia-aberta.pt, documenting the progress on the national agenda for Open Science and acting as a resource hub for Open Science, containing a specific glossary for Open Science, advocacy and informational materials, and as a publicity outlet for other Open Science initiatives and events; periodic Research Data Management Forum events to improve skills, communication and mutual understanding among researchers and other stakeholders; initiatives to connect research with society, namely cultural agents; and international cooperation on Open Science with Portuguese-speaking countries.

Specifically, a set of actions was launched to address the issue of the perceived low level of promotion and uptake of Open Data in Portugal, both at the infrastructure level and capacity-building and training levels. These actions are intended to address data management needs from the different research areas as well as to interoperate with the future European Open Science Cloud, at the infrastructure level.

So far, altmetrics are not used in assessing research outputs. They have been discussed in the diagnosis and recommendations issued by the subgroup of the National Open Science Policy focusing on scientific evaluation. Examples of such recommendations are:

- Quantitative metrics, if used, should always complement a qualitative evaluation process performed by experts in the field and the use of inappropriate metrics such as the journal impact factor (JIF) should be disregarded;

- When appropriate, consider adopting altmetrics in research evaluation processes by using data providers which have adopted the NISO Altmetrics Data Quality Code of Conduct;

- OS practices should be included in research evaluation and hiring processes;

- Include and consider the different research outputs in the research assessment processes, both traditional, such as publications, and non-traditional, such as data and software;

- Only publications deposited in institutional Open Access repositories should be considered within hiring or evaluation processes.

Currently, no specific rewards or incentives have been established.

However, the Liège model was adopted by two institutions, Instituto Politécnico de Bragança and the University of Minho, linking research assessment to the availability of outputs in their Green Open Access repository. This has put the two institutions in second and fifth place, respectively, of all the world's research institutions in terms of volume of repository content, according to the survey described in the Pasteur4OA project report Open Access Policy: Numbers, Analysis, Effectiveness. IP Bragança achieved a full-text article deposit rate of

85.8 %, with 56.9 % of articles available in Open Access.

A new FCT regulation on the evaluation of research units was published in September 2017. According to this, the research units should no longer send in lists of publications, except for those publications selected as most relevant. In addition, references to bibliometrics or impact factors are no longer allowed. Data-sharing practices and societal impact have been included as criteria to assess the quality and relevance of the research. Open Access to the unit‘s outputs must be permanently assured.

Future steps and measures to be taken

The whole Open Science movement is considered high priority for science policy in Portugal. Within this movement, and also as a way to improve the quality of research and research management, particular attention is being paid to improving the evaluation systems, advancing the open data agenda and data infrastructures, boosting the level of data-management-related skills and the proper monitoring of Open Science policies.

The next steps are already very clear and include:

- Publication of the National Open Science Policy, following the recommendations already produced and an external review by international experts;

- Development of a networked infrastructure geared towards data sharing, preservation and management. This is expected to include a central node coordinating with the EOSC initiative and supplying a range of services, such as setting technical standards and aggregation as well as training and advocacy in Open Data-related areas;

- Design, publish and implement a mandatory policy for the sharing and management of data arising from FCT-funded research;

- Devise and implement a reliable method to monitor compliance with FCT's Open Access policy;

- Implement a broad communication strategy towards Open Science among the research community.

Further specific actions are expected (and needed) in the field of research evaluation, in line with the MLE conclusions and with the National Open Science Policy Working Group own recommendations, such as:

- Promote the alignment of Open Science policies at the national level and establish a clear link between these policies and evaluation of research and HEI faculty and hiring processes;

- Promote the articulation and alignment of criteria within evaluation processes between the funding agencies and the agency that performs the assessment and accreditation of HEIs and their study cycles;

- Continue to support and develop the PT-CRIS project, which will facilitate the link between research and HR assessment and Open science practices, and provide an integrated ecosystem for research management, with a range of services for institutions and funders (monitoring, benchmarking, evaluation), researchers (authorship, CVs) and other interested parties (access to research outputs);

- Fully implement technical measures to link the publications resulting from FCT funding deposited in RCAAP to FCT's evaluation systems;

- Promote the creation of a working group of Portuguese HEIs to participate in the Snowball Metrics Exchange Service, aiming for greater harmonisation of the information;

- Explore incentives such as awarding prizes to researchers who show generalised adoption of Open Science practices;

- Engage the different stakeholders in designing, monitoring and reviewing any quantitative metrics intended to be used in research-assessment processes;

- Whenever deemed appropriate, include standardised metrics in research evaluation processes to enable international comparisons and to precisely assess efficiency and productivity differences.

With these actions in place, the uptake of Open Science is expected to grow immensely, with a significant increase in publications and data access and reuse. In addition, a more efficient research management system, better serving the needs of researchers and institutions' needs, should be implemented, contributing to the general improvement in national research, responsive to societal demands.

It is a stated objective of this government to achieve 100 % Open Access of publicly funded research as soon as possible.

For further information on Portugal's situation and plans, please contact Vasco Vaz at Vasco.Vaz@fct.pt or Joelma Almeida at Joelma.Almeida@fct.pt

4.9.2 Important links

- Government Open Science website: http://www.ciencia-aberta.pt/home ; National Open Science Policy webpage: http://www.ciencia-aberta.pt/nosp

- First report (Open Science diagnosis) of the National Open Science Policy Working Group (only in Portuguese):

  http://media.wix.com/ugd/a8bd7c_1ca622bff7f34abbad228ac94e1eda16.pdf

- Second report (recommendations for Open Science policy design) of the National Open Science Policy Working Group (only in Portuguese):

  http://docs.wixstatic.com/ugd/a8bd7c_3274046fc8ce42c78db2ec1707c0a0fd.pdf

- Decree-Law 115/2013 (only in Portuguese):

  https://dre.pt/web/quest/pesquisa/-/search/498487/details/maximized

- RCAAP project:

  http://projecto.rcaap.pt/index.php/lang-en/sobre-o-rcaap/servicos

- Policy on Open Access to publications arising from FCT-funded research (only in Portuguese):

  http://www.fct.pt/documentos/PoliticaAcessoAberto_Publicacoes.pdf

- Policy on management and sharing of data and other results arising from FCT-funded research (only in Portuguese):

  http://www.fct.pt/documentos/PoliticaAcessoAberto_Dados.pdf

- PT-CRIS: https://ptcris.pt/en/hub-ptcris-en/

4.10 Slovenia

"A deep understanding of the problem is a prerequisite for a quality implementation. This was my motto in participating in this important MLE. Teamwork of a whole group with excellent guidance and support is a good foundation in the process to make Open Science in Europe happen."

Dr **Ivan Skubic**, Secretary at the Ministry of Education, Science and Sport, Science Directorate, is performing tasks in selected European research programmes (Horizon 2020) as a programme committee member and a National Contact point. As Open Science became a priority, he took over duties in this important area as well, including membership in the ERAC SWG on Open Science and Innovation.

Personal motivation and learnings from the MLE:

Implementing a new concept in science, in particular when it has clear benefits for society, is a challenge for every forward-looking country. The MLE on Open Science, through the excellent guidance of its experts, shows the whole complexity of the problem: not only the implementation, but even a simple common understanding of the concepts and their implications is a challenge in itself. Yet, at the end, if we want to harmonise and make the project successful, we have to transpose it into simple, manageable steps. The MLE on Open Science is, in my eyes, a huge success. Through its learning processes, personal contacts as well as many useful debates and documents it has equipped us with good understanding of the problem and the many tools necessary to make further steps in its national implementation properly directed and easier.

4.10.1 National context

Current status

In September 2015, the Government of the Republic of Slovenia adopted the 'National strategy of Open Access to scientific publications and research data in Slovenia 2015-2020'. The strategy is fully aligned with the Open Access mandate in Horizon 2020. All peer-reviewed articles from publicly funded research must be openly accessible. The strategy also includes a chapter on the Open Research Data pilot, in line with the H2020 programme, and covers data management planning, plus recommendations about where to store data for the longer term. Also, journals, published by publishers based in Slovenia, containing peer-reviewed articles and receiving national public funding for their activities, must be openly accessible.

In May 2017, the Government of the Republic of Slovenia adopted the 'Action plan for the implementation of the national strategy of Open Access to scientific publications and research data in Slovenia 2015-2020'. The plan covers activities, indicators, responsible and cooperating institutions for the implementation of actions, time frame and financial resources.

In November 2017, public consultation was opened for the draft Research and Development Act, whereby the legal background is defined for Open Science, and for Open Access according to the national Open Access strategy.

Research-performing organisations have not yet adopted Open Access mandates.

Fifty-two Slovenian scientific journals are indexed in the Directory of Open Access Journals. The electronic versions of all publicly co-financed Slovenian journals (138 titles) and final reports of research projects, financed by the Slovenian Research Agency, as well as doctoral dissertations must be deposited in Slovenia's Digital Library.

Open Science is implemented mainly through the dedicated web portals such as 'Open Access Slovenia', built by Slovenian universities and research institutions and supported by the ministry and research agency. Open Access Slovenia holds information on Open Science and Open Access in the Slovenian language. The portal harvests metadata from Slovenian repositories and other archives for scientific publications and research data, which enables joint display and federated search in the portal.

In November 2017, there were 11 open access repositories listed in OpenDOAR, 10 of which were active, OpenAIRE compatible and included in the OpenAIRE portal. The only research data archive in the country is the Social Sciences Data Archive, which is a member of the Consortium of European Social Science Data Archives CESSDA of the European Research Infrastructure Consortium ERIC and listed in re3data.org. The Research Infrastructures Roadmap 2011-2020 envisages international cooperation by Slovenia in ESS, DARIAH and CESSDA projects. Building an open social sciences and humanities research infrastructure is also anticipated.

Public discourse is currently focusing on Open Access. Stakeholders in these discussions are the Ministry of Education, Science and Sport, the Slovenian Research Agency (ARRS), the Slovenian Rectors' Conference and other public research institutes. Currently, there is no institutional structure or specific venue dedicated to Open Science in Slovenia. ARNES is a Slovenian NREN and as such is part of the pan-European research network GÉANT. Similar to the planned European Open Science Cloud, ARNES provides e-infrastructure and services (public and procurement) that are essential for the implementation of Open Access policies. ARNES is the administrative point for membership of Slovenian HPC and Open Data community (SLING) in European projects and associations (EGI, PRACE, etc.).

The largest share of basic research in Slovenia is funded through the Research Group Programme funding, whereby the funding is allocated on the basis of a public call issued by the Slovenian Research Agency. Support from this competitive funding scheme is based on ex-ante assessment and is provided for up to six years. Peer review is done by external evaluators. There are currently no short-term ambitions to shift to a performance-based system using more quantitative metrics. Nevertheless, Slovenia is testing alternative metrics in that respect. In 2016, the national Institute of Information Science (IZUM) introduced altmetrics into Slovenian researchers' bibliographic data. From both the practical and technical points of view, altmetrics can already be practised in Slovenia for testing and learning purposes, although it is not yet part of the official evaluation system. Since 2016, with COBISS/SciMet, researchers have been able to monitor the performance of their publications using a combination of Altmetric.com and PlumX.

Research data, which are deposited in data archives and catalogued for the national CRIS (SICRIS – Slovenian Current Research Information System), are recognised as scientific objects and rewarded with points as incentives. In addition, there is funding for Open Access repositories. Currently, most incentives and rewards are handled at the institutional level.

In line with implementing the country's Open Access policy, Slovenia has been establishing working groups comprising representatives of different stakeholders, nominated by the ministry. A similar structure is conceptualised for Open Science. However, a national roadmap for Open Science has not yet been developed. Slovenia endorses the coordinated EU efforts to harmonise Open Science activities.

Future steps and measures to be taken

The present legal and institutional system in Slovenia is not sufficiently supportive in terms of addressing and regulating Open Science's essential attributes and/or promoting its values. The main activities to improve the situation are associated with the implementation of the Action plan for Open Access to Scientific Publications and Research Data in Slovenia 2016-2020 with all its concrete measures, responsible institutions for individual measures and deadlines for their implementation. 'An analysis of the evaluation of science and research by national research funders and preparing a proposal for changes in the direction of Open Science' and 'Analysis of the evaluation of science at higher education institutions and research institutes and preparing a proposal for changes in the direction of Open Science' are already two important tasks which are part of this action plan.

Although the important tasks in the direction of Open Science are envisaged and many of them (e.g. Open Access to scientific publication and research data) are already supported by wider EU initiatives, there are other aspects that still need to be properly addressed (e.g. new-generation metrics, incentives and rewards to engage with Open Science, career assessments, HR strategies, etc.). An EU-coordinated approach to implementing these concepts is therefore considered of utmost importance. This is even more important for small countries, which have to pay a great deal of attention to resources, avoid

unnecessary actions, experiments or even mistakes. We consider implementing Open Science by means of common EU guides for preparing and implementing a National Open Science Road Map is a good approach. This could enable an effective and efficient way forward. Mutual learning, sharing experiences, best practices or even resources, will be associated with this. By applying such an approach, it is possible to considerably speed up existing European and national Open Science processes and align them with wider global trends. We expect that further progress by the EU and ERA in this respect will provide EU Member States with the basic source of information, best practices and role models to further enable and support us in making proper, harmonised steps.

Important tasks in implementing Open Science in Slovenia in future are to understand which scientific structures in the country need to be upgraded and how. This starts with the awareness of policymakers and management staff, training trainers and staff, engaged in Open Science as well as researchers. More often than not, it is not about new structural units but upgrading the existing ones, including the availability of staff.

It is good that present draft strategic documents (e.g. Strategy of development of Slovenian higher education libraries) and draft legislative documents (e.g. draft R&D Act) are envisaging the importance of Open Science and that there is awareness at the ministry of the importance of making further progress. However, the most important issue remains to reassure people that Open Science is not implemented through enforcement but rather with well-established awareness, knowledge and skills at all levels and properly shaped reward systems that incentivise Open Science activities.

For further information on the Slovenian situation and plans, please contact dr. Ivan Skubic at ivan.skubic@gov.si.

4.10.2 Important links

- Action plan for the implementation of the national strategy of Open Access to scientific publications and research data in Slovenia 2015-2020: http://www.mizs.gov.si/fileadmin/mizs.gov.si/pageuploads/Znanost/doc/Odprti_dostop/Akcijski_nacrt_-_POTRJENA_VERZIJA.pdf

- National strategy of Open Access to scientific publications and research data in Slovenia 2015-2020:

  http://www.mizs.gov.si/fileadmin/mizs.gov.si/pageuploads/Znanost/doc/Zakonodaja/Strategije/National_strategy_for_open_access_21._9._2015.pdf

- Ministry of Education, Science and Sport of the Republic of Slovenia: http://www.mizs.gov.si/

- Slovenian Research Agency (ARRS): https://www.arrs.gov.si/sl/
- ARNES, The Academic and Research Network of Slovenia: http://arnes.splet.arnes.si/en/
- IZUM, Information centre for Slovenian science, culture and education:

  https://www.izum.si/en/
- COBISS/SciMet portal (implementing altmetrics):

  http://scimet.izum.si/en/altmetrics
- SICRIS, SlovenIan Current Research Information System:

  http://www.sicris.si/public/jqm/cris.aspx?lang=eng&opdescr=home
- Open Access Slovenia portal: https://www.openaccess.si
- Open Science Slovenia portal: http://www.openscience.si
- Slovenian strategy for strengthening the European Research Area 2016-2020 (ERA Roadmap):

  http://www.mizs.gov.si/fileadmin/mizs.gov.si/pageuploads/Znanost/doc/Zakonodaja/Strategije/SI_ERA_Roadmap.pdf
- Research Infrastructure Roadmap 2011-2020 (Revision 2016):

  http://www.mizs.gov.si/fileadmin/mizs.gov.si/pageuploads/Znanost/doc/Strategije/NRRI_2016-ENG.pdf

4.11 Sweden

"Sweden is in an intensive conversion process, from a traditional system to a system characterised by openness and engagement. We have not yet come up with solutions on how to make the conversion in full detail; there's a lot to learn from the MLE. One problem we consider important is to find the answer to how we can change the assessment systems so that these are adapted to Open Science"

"The exercise has shown the importance of having a nationwide strategy that meets the need to reward Open Science activities. The systems need to be adjusted so that they take account of efforts made by researchers who are willing to engage in Open Science. Normally, we label this as the need to establish incentives and rewards. In this perspective, the findings presented in the MLE reports will certainly be useful."

"For many years, Sweden has had several institutions and organisations active in the field of Open Access. Now is the time to take the next step and broaden the field of openness – that is, to approach Open Science as an opportunity to make research and innovation (all outputs, the process, education, career assessment, etc.) more open and, as a consequence, more inclusive, effective and valuable for society."

"The MLE clearly shows how different Member States have interpreted Open Access and Open Science, but also how differentiated work is in the countries which are part of this exercise. Some have found working methods that are of interest to Sweden, so we will be happy to closely follow the development in those countries, with an ambition to collaborate and exchange best practices."

Thomas Neidenmark, PhD, head of section, Division for Research Policy, Ministry of Education and Research: administrates Open Science policies for the Swedish government.

Beate Eellend, PhD, Open Access coordinator, National Coordination of Libraries, Public Programmes Department, National Library of Sweden: Coordinates the national programme for Open Access to publications in Sweden.

Lisa Olsson, PhD, analyst, Stockholm University, Stockholm University Library: coordinates the national evaluation of offset agreements in scientific publishing in Sweden.

Lisbeth Söderqvist, associate professor and senior analyst, Department of Research Policy, Policy Advice Unit, Swedish Research Council: advises the government on Open-Access-related issues and cooperates with the National Library of Sweden on the national programme for Open Access to publications.

4.11.1 National context

Current status

Sweden is a research-intensive country. The Swedish research funding system includes three research councils and an innovation agency. The largest of the research councils (Swedish Research Council) covers all areas of research. The other two (Formas and Forte) are focused on specific sectors (e.g. environment, health) and operate under the appropriate ministry. The Ministry for Education and Research has the overall coordinating responsibility. The government produces a national research bill every four years, the most recent of which was introduced at the end of 2016. The Swedish Research Bill from 2016 sets out the next 10-year research policy. It includes the national goal that scientific publications which are the result of publicly funded research – and the underlying research data – should be made immediately Open Access upon publication.

As a response to the 2012 recommendation from the European Commission, the Swedish government assigned the Swedish Research Council to produce national guidelines for Open Access in cooperation with the National Library of Sweden. The latter has been the driver for the implementation of Open Access in Sweden since 2006.

A report 'Proposal for National Guidelines for Open Access to Scientific Information' was published in 2015. It has been publicly accepted by the government. It is very much an identification of the obstacles and problems for Open Access to publications and research data, although it also includes stepwise implementation of a national policy for Open Access to publications. The report suggested further investigations into the problem areas identified and recommended that the government gave the task of coordination to an appropriate authority. As a result, since 2017, the National Library of Sweden has the national coordination task for Open Access to publications and the Swedish Research Council has one for research data.

There is a national advisory group for Open Access to publications coordinated by the National Library of Sweden. With this new national coordination task, the National Library, via the advisory group,has appointed a number of working groups assigned to further investigate the problems and obstacles identified in the proposal for national guidelines. The goal is to submit recommendations to the advisory group and the National Library, which will then make

recommendations to the government. All main stakeholders are represented in the advisory group as well as in the five working groups (HEIs, funders, researchers, etc). The problems and obstacles identified by the five working groups:

- Incentives and rewards for researchers
- The monitoring of the mandates
- Costs and financial adjustments
- Open Access to monographs
- Financial and technical support for national journals.

Three of the four largest public funders (including the Swedish Research Council) have mandates on Open Access to publications dating back to 2010. Articles and conference articles must be published as Open Access, Green, Gold or Hybrid. This also applies to many foundations. Grants are available for Open Access publishing of articles and books, providing an incentive for researchers to publish via Open Access. Generally, to date, policies on Open Research Data exist to a much lesser extent than mandates on Open Access to scientific publications. At the moment, there are only one or two Swedish funders with a mandate, or recommendation, for Open Access to data.

Sweden has many repositories where researchers may archive their output and make their articles Open Access . These are normally part of the university's infrastructure. Almost all HEIs have recommendations to publish research results Open Access and four have mandatory Open Access policies. The Association of Swedish Higher Education (SUHF) signed the Berlin Declaration in 2005 and following that recommended that their members take the following measures to fulfill the Berlin Declaration: to impose a policy that strongly recommends the researchers deposit a copy of each published article in an open, digital archive/repository, and encourage the researchers to publish their research articles in Open Access scholarly journals, when a suitable one exists, and to give the necessary support to make this possible. Also, the Association of Swedish Higher Education has recently established a coordinating group on Open Science with the goal of immediate Open Access by 2026. Some university libraries are currently experimenting with altmetrics, although no applications in research assessment have been documented.

Most of the records from the HEIs' local repositories are harvested and can be found in the SwePub search service, run by the National Library of Sweden. SwePub is the national publication database which is also developing services for national analyses and bibliometric data, e.g. statistics on Open Access publishing in Sweden.

A number of initiatives and activities on Open Access can be found on the National Library of Sweden's platform openaccess.se.

Future steps and measures to be taken

In December 2017, the government appointed the National Library of Sweden and the Swedish Research Council to develop indicators to assess the extent to which scientific publications and research data, which have been fully or partially produced by public funding, comply with the so-called FAIR principles and meet the national objective of Open Access being fully implemented in 2026. The indicators should enable an assessment of whether scientific publications are immediately available on publication. Based on the assessment indicators presented, the National Library shall also propose a method that shows a comprehensive picture of scientific publications and research data together at both the national level and for publicly funded research institutions, respectively. The assignment on publication must be reported to the government offices (Ministry of Education and Research) no later than 28 February 2019, and the assignment on research data by 1 December 2018.

The Bibsam Consortium is driving the transition to Open Access by combining Open Access and licensing in negotiations with international scientific publishers. The goal is to redirect the payment flows from a subscription-based to an Open-Access-based publishing system, to reach transparency and monitor the total costs of scientific publications, and to facilitate Open Access to scholarly publications. The National Library compiles data on the APCs in cooperation with the HEIs. Since 2018, the government has requested the National Library to compile details of the total expenditure on scientific publishing. The National Library will pay particular attention to costs for subscriptions, APCs and administrative expenses. One university in Sweden has taken a concrete responsibility for the transition to Gold Open Access beyond the Bibsam Consortium. Stockholm university has identified its four most-frequently used publishers and made a deal on APCs for publishing in their Gold Open Access journals. In these deals, Stockholm university covers APCs with the library's budget.

Within the 2017 national coordination task for Open Access to research data, the Swedish Research Council is considering asking for data management plans in applications for funding.

In addition, a roadmap for e-infrastructure for research will be established to meet the challenges concerning the increasing need for research-data handling. This will be led by HEIs cooperating with the Swedish Research Council.

The Swedish Research Council and the National Library will continue to give financial support to initiatives such as the Directory of Open Access Journals (DOAJ), Kriterium, Open Library of Humanities, and Knowledge Unlatched (KU), since it is important to support an Open Access infrastructure, of which these are examples.

For further information on the situation in Sweden and plans concerning Open Access to publications, please contact Beate Eellend at Beate.Eellend@kb.se

Concerning the situation in Sweden and plans concerning Open Access to research data, please contact research officer Karl Gertow at Karl.Gertow@vr.se or research officer Susanna Bylin at Susanna.Bylin@vr.se

4.11.2 Important links

- The National Library of Sweden: http://www.kb.se/openaccess/Hjalptexter/English/
- Openaccess.se: http://openaccess.blogg.kb.se/english/
- Swepub: http://bibliometri.swepub.kb.se/bibliometri
- SUHF: The Association of Swedish Higher Education SUHF (only in Swedish) www.suhf.se
- Kriterium, an initiative for Open Access book publishing: https://www.kriterium.se/site/en-welcome/
- The Swedish Research Council: https://www.vr.se
- Formas: The Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning www.formas.se
- Forte: The Swedish Research Council for Health, Working Life and Welfare www.forte.se
- Vinnova, Sweden's Innovation Agency: www.vinnova.se

4.12 Switzerland

Myriam Cevallos: *"The experience of mutually learning about the national approaches and common challenges around Open Science was incredibly valuable. The MLE gave me the opportunity to see difficulties around Open Science from multiple perspectives and to think about out-of-the-box solutions that go beyond the usual discussions."*

Tobias Philipp: *"Getting at common questions from different angles is a very valuable experience provided by the MLE. Even more so, when solutions to those questions benefit so much from joint positions and aligned action, as in the case of Open Science."*

Myriam Cevallos is a scientific advisor at the State Secretariate for Education, Research and Innovation. She acts as the Swiss National Point for access to and preservation of scientific information (NRP) and follows the development around Open Science in Switzerland.

Tobias Philipp is a scientific advisor in the strategy support division of the Swiss National Science Foundation. He is coordinating the SNSF's Open Access policy and various other tasks concerning the future development of SNSF's strategy, evaluation and funding practices.

Personal motivations and learnings from the MLE:

Myriam Cevallos: The value of sharing scientific information is critical for scientific progress. The MLE offered the possibility to have an insight into the ways in which the sharing of science is implemented in the different national settings and the hurdles the different players have encountered while doing so. Thanks to the vivid discussions and skilled input from the experts, the MLE resulted in inspiring and innovative ideas to overcome the challenges encountered.

Tobias Philipp: Since sustainable change in the highly international scientific system is not achievable by any one nation on its own, the MLE provided opportunity to clarify common issues and overarching yet abstract strategies. It also enabled us to better understand the different challenges and needs any of the member countries face when tailoring abstract ideas towards national structures. This knowledge is very valuable when working collaboratively towards Open Science and beyond.

4.12.1 National context

Current status

Currently, Swiss HEIs are strongly focused on Open Access publication policies. However, the development of a national policy on Open Access to data should be discussed in 2018. Switzerland has a National Open Access Strategy which was designed by swissuniversities (Switzerland's umbrella organisation of HEIs) and the Swiss National Science Foundation (SNSF). The National Strategy was adopted at the beginning of 2017 and includes the vision of all publicly funded research being freely accessible by 2024. The idea of the Strategy is to find common interest and a 'common voice' while respecting Switzerland's institutional diversity. The Action Plan, with concrete activities to implement the National Open Access Strategy, should be put into action in 2018. Furthermore, swissuniversities' 'Scientific Information' programme promotes the harmonisation of today's distributed efforts by universities to provide and process scientific information. This includes the development and support of services which may be of use for Open Science. The programme also addresses research data.

Apart from its involvement in the National Strategy, the SNSF has its own Open Access policy. The SNSF is Switzerland's leading provider of scientific research funding. With its federal mandate, it supports basic research in all disciplines, and evaluation is based on peer review. The SNSF requires grantees to provide Open Access to research results obtained with the help of SNSF grants. Researchers receiving SNSF funding can cover the costs of publishing articles and monographs in Gold Open Access, from April 2018 onwards, and even beyond the end of their grant. Furthermore, the SNSF's Open Data policy has been active since October 2017. Applicants for SNSF funding must include a data management plan (DMP) in their proposal. The DMPs are not taken into account in the evaluation, but are a formal requirement of the proposals. A DMP can be edited during the course of the project, and the final version is made publicly available. OpenDOAR lists 18 OA repositories in Switzerland. Besides the SNSF, a few Swiss academic research institutions have installed Open Access mandates concerning scholarly publications by their researchers. Such institutional policies have been formulated by the ETH Zurich, the University of Bern, the University of Geneva, the University of St Gallen, and the University of Zurich (ROARMAP). DOAJ lists more than 230 Open Access journals from Switzerland. The majority are published by MDPI AG (Basel) and Frontiers (Lausanne). A further 352 digitised journals are freely accessible at retro.seals.ch.

Switzerland's academic research institutions receive much of their financial support from the respective cantons and/or from the federal Swiss government via SERI. SERI uses quantitative measures to determine the allocation of basic institutional funding and when trying to determine the impact of public R&I investment in reporting back to political decision-makers, relying on various indicators and data that go beyond bibliometrics.

Altmetrics are not used systematically to assess scientific quality in Switzerland. However, there is growing interest among the relevant stakeholders to move

away from an evaluation system purely based on number of publications and impact factors.

Overall, in Switzerland's federal, bottom-up system, research funders and publicly funded institutions have a large degree of autonomy in defining and implementing Open Science policies and practices. However, Swiss institutions follow common approaches and national regulations. To do so, they count on the support of public authorities. This is why the SERI mandated swissuniversities to develop a National OA Strategy (adopted in 2017), and followed up with a similar mandate for Open Data in 2017.

Future steps and measures to be taken

In 2018, swissuniversities will start discussing a potential national strategy for Open Research Data, following a mandate by the federal ministry. Furthermore, in 2018, Switzerland should start carrying out the actions proposed to implement the national strategy on Open Access. Incentives and rewards will be a topic for discussion in these two activities.

For further information on Switzerland's situation and plans, please contact Myriam Cevallos at myriam.cevallos@sbfi.admin.ch

4.12.2 Important links

- https://www.swissuniversities.ch/fileadmin/swissuniversities/Dokumente/Hochschulpolitik/Open_Access/P06_7.0_1-01_Open_Access_strategy_EN.pdf
- https://www.swissuniversities.ch/en/organisation/projects-and-programmes/p-5/
- http://www.snf.ch/en/theSNSF/research-policies/open-access/Pages/default.aspx#National%20initiatives
- http://www.snf.ch/en/theSNSF/research-policies/open_research_data/Pages/default.aspx

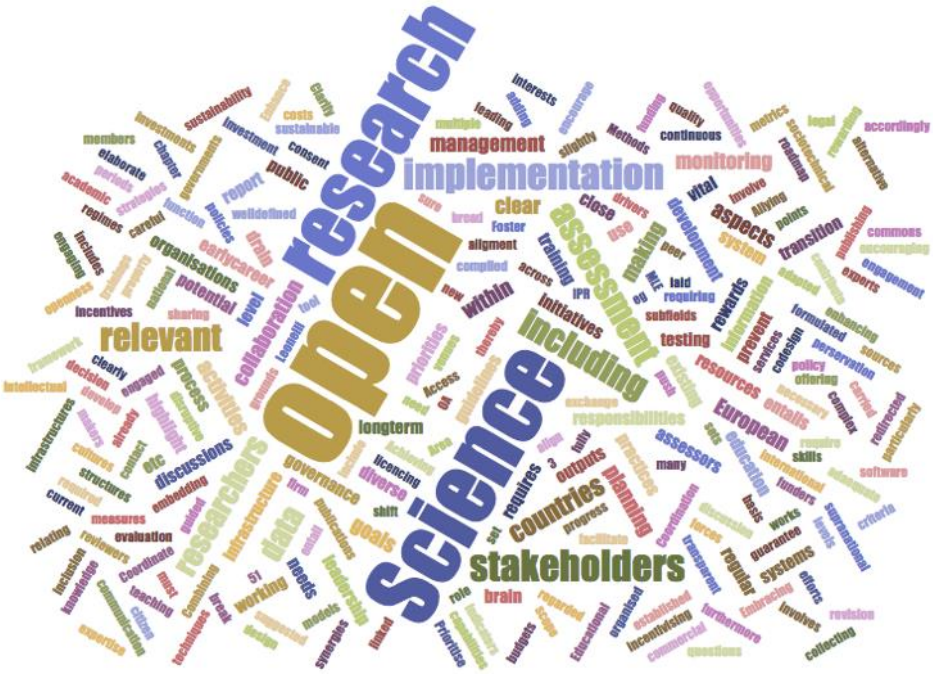
5 LESSONS LEARNED

The aim of this MLE is to support countries in designing, implementing and/or evaluating different approaches and instruments for the implementation of Open Science in areas where there is limited practical experience: the use of altmetrics, the development of incentives and rewards, as part of the implementation of concerted or national initiatives. This exercise adopted a 'learning by doing' approach, based on the expertise of all participants.

First, we collect the key concerns raised during the MLE and present potential actions. Second, we list the key priorities identified in the discussions before we finally present the next steps for the implementation of Open Science at the country level as a roadmap, which should be informed of the key concerns and priorities.

This report concludes by drawing lessons for the prudent design of interventions in the current research system with the aim of improving it. By identifying good practices, reflecting participants 'good and bad experiences, we develop a checklist with operational recommendations to be used by various stakeholders in the Open Science arena.

Figure 7: Word cloud generated from this chapter


open
research
Science
implementation
management
monitoring
assessment
including
stakeholders
relevant
researchers
countries
planning
data
goals
needs
working
collaboration
organisations
potential
level
aspects
clear
close
development
transition
rewards
within
initiatives
testing
resources
European
assessors
education
systems
regular
longterm
responsibilities
outputs
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governance
discussions
etc
priorities
training
making
use
vital
brain
interests
leading
quality
continuous
accordingly
metrics
legal
sustainability
costs
sustainable
investment
consent
public
report
policies
drain
earlycareer
incentives
sharing
process
activities
highlight
engaged
clearly
decision
intellectual
infrastructures
culture
structures
measures
evaluation
relating
reviewers
coordinate
inclusion
knowledge
teaching
expertise
technologies
trend
models
synergies
linked
budgets
educational
commercial
questions
collecting
involves
revision
formulated
enhancing
sources
preservation
policy
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complex
redirected
particularly
software
criteria
transparent
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works
basis
forces
facilitate
progress
shift
licencing
firm
publications
social
leadership
role
priorities
requirements
organised
established
incentivising
furthermore
embedding
contact
already
develop
culture
current
infrastructure
measures
evaluation
coordinate
teaching
knowledge
inclusion
communications

5.1 Key concerns and best practices in Open Science implementation

MLE participants regard Open Science as an opportunity to reorganise the science system as a whole, challenging some of the unfair and unproductive aspects of current research and evaluation practice. One delegate put it like this:

"The most important lessons learnt are that Open Science uptake needs a comprehensive approach addressing every aspect, from assessment to infrastructures to incentives, in order to be effective. If only some components of the system are addressed, any approach is very likely to fail. Honesty, transparency and making abundant information available to all stakeholders, particularly researchers, is crucial. The comprehensive approach must also extend to the range of stakeholders involved, with the engagement of all major research stakeholders. In particular, the full involvement of researchers right from the start of Open Science policy design and implementation is mandatory."

Rewards in Open Science are about changing the way research is done, who is involved and how it is valued. Small fixes are not enough: implementing Open Science requires systemic and comprehensive change in science governance and evaluation.

Below are the key concerns that arose in discussions during our meetings. They are illustrated by good practices and potential actions to emphasise our solution-oriented exchange of experiences.

1. What matters?

Open Science is about improving the quality, accountability and social contribution of research while striving to minimise bureaucratic and administrative burdens on researchers and research institutions. Demarcating the social role of research in society and intended impacts will always be a political debate, and depends on who takes on the responsibilities. However, MLE participants raised concerns that it will not be easy to maintain a multifaceted approach to identifying and measuring the impact of research, in particular of open scholarship and open institutional practices. Furthermore, in many countries, it will be necessary to kick off the debate with a broad information and communication campaign as those topics are not broadly discussed at all. Awareness raising will be key to attracting the necessary public attention.

Good practice:

i) Finland

The Finnish Ministry of Education and Culture conducted an evaluation of the openness of Finnish research-performing organisations and research-funding organisations as part of the 'Open Science and Research Initiative

(ATT)'. For the report on 'Evaluation of Openness in the Activities of Research Institutions and Research Funding Organisations in 2017'[84], innovative indicators were created to gauge the performance of openness. However, since this is a very new and still unexplored field of evaluation, key indicators are used to provide insights on the competences and capacities of the research system itself in supporting open practices. They are not used for performance evaluation of the institutions under study. They provide vital information for the identification of national strengths and weaknesses, and for the identification of areas where support and cooperation should be encouraged more. They also provide a training ground for assessors to deal adequately with a set of manifold measures and complexities of impact definitions.

ii) Austria

The Citizen Science Network Austria is currently developing a set of quality criteria for citizen science projects to be included on the platform 'Österreich forscht'.[85] This debate covers not only what good conduct citizen science projects should follow, but it also asks the question as to what role publicly funded research should serve in society and how citizens can engage more an better in such research. Bringing in the Vienna Principles[86] – a set of 12 cornerstones of good scholarly practice – and the discussion on Scholarly Commons,[87] the new Citizen Science quality criteria will provide a substantial reference framework for discussions on the societal impact of research and Open Science implementation.

Actions: Open up the societal debate on research impact. Devise a clear communication and PR strategy. Experiment with different forms of open evaluation. Encourage dialogue among citizens and researchers. Take advantage of participatory approaches and Citizen Science initiatives to bring together multifaceted opinions on what matters.

2. Altmetrics

Many MLE participants voiced their concerns that altmetrics will make it easy to simply carry on the bad practice of impact factors and the like. In today's audit society, such metrics might seduce their users into focusing their attention only on what is measurable and once again to end up with proxies far too simplistic for decision-making. However, while there are still many concerns, MLE participants also recognised their potential to: 1) make

[84] Finnish Evaluation of Open Science practices: https://www.doria.fi/bitstream/handle/10024/146284/Evaluation_of_Openness_2017_FIN.pdf?sequence=1&isAllowed=y

[85] http://www.citizen-science.at/

[86] http://viennaprinciples.org/

[87] https://www.force11.org/group/scholarly-commons-working-group

visible new forms of scholarly communication; 2) broaden our understanding of the multiple types of social impact of research, for instance by mapping interactions of people and organisations; and 3) evaluate all influences of various types of scientific outputs and activities. Delegates had many suggestions for the types of metrics that could be useful for their work: for instance, indicators of attention for teaching, open education resources or higher education activities; visibility of research in journalism; and uptake of scientific concepts in policy documents. There was consent that altmetrics will help to break away from traditional citation-based indicators and that they can promote change in the academic evaluation system, when tied to incentives and rewards. But this will require time and will mean careful management of parallel systems of assessment in two forms of open science: on the one hand, we have the traditional reward system based on publications that is enhanced with new indicators (e.g. data citations); and on the other hand, we face totally new practices and forms of openness, such as open peer review, which will lead to new forms of assessment.

Good practice:

Several participating countries have either piloted the use of altmetrics or studied their performance.

i) Slovenia

Slovenia presented a pilot study on the use of altmetrics within the COBISS/SCiMet system. Researchers could monitor the performance of their publications by using different altmetrics alongside traditional ones.[88]

ii) Austria

Austrian Science Fund FWF has published two studies on the feasibility of altmetrics.[89.]

iii) France

MLE participants described the HIRMEOS[90] project in France, which has yet to be implemented. Its focus is on Open Access monographs and it includes a mutual approach to the design and implementation of alternative metrics within a community, attracting attention to the particularities of measuring the quality and impact in social sciences and humanities.

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[88] http://www.cobiss.si/cobiss_eng.html

[89] https://www.fwf.ac.at/en/about-the-fwf/funding-statistics/altmetrics/

https://zenodo.org/record/28229

http://scilog.fwf.ac.at/en/article/6883/alternative-science-metrics

[90] http://www.hirmeos.eu/

Actions: Encourage experimentation with alternative and responsible metrics. Exchange experiences with other countries, across organisations and within research communities. Involve publishers and learned societies in the debate. Make open data for bibliometrics mandatory, such as open citations. Sign the DORA declaration. Train assessors to: not use the journal impact factor; always evaluate research quality, performance and impact against a clear set of goals and missions; use quantitative measures together with qualitative ones; make research assessment transparent and reward this; and regularly scrutinise indicators in use.

3. Incentives and rewards

The improvement of the incentive and reward system is a core necessity in the implementation of Open Science. Discussions during the MLE revealed that only a few types of Open Science incentives and rewards are currently being implemented and we are facing more reluctance to develop new incentives. The most prominent example mentioned was the Liège model which is based on ORBi, the institutional repository at the University of Liège in Belgium. It required a lot of personal effort by the people involved and a strong communication campaign until researchers went along with its mandatory linkage of internal assessment to research output stored in ORBi. However, now the repository is striving and the Green Open Access mandate has become the default mode of secondary publishing. There is even a decree in preparation that will enlarge such a mandate to all publicly funded research in French-speaking Belgium (Wallonia-Brussels Federation). The discussion during the MLE also exposed the necessity to develop more incentives for stakeholders other than researchers, so Leonelli S. developed the scheme presented in chapter 3: the scopes of incentives for researchers, research organisations and funders, and last but not least, for national governments and policymakers (see table 4 in section 5.3). Given the highly international nature of research networks, international coordination is crucial for the effective implementation of comparable measures. At the same time, each Member State, research funder and research-performing organisation needs to review the extent to which specific incentives will work in its specific context, and adapt the requirements discussed in this report accordingly.

Good practice:

i) Survey on Open Peer Review

A survey on Open Peer Review (Ross-Hellauer et al., 2017) analyses the attitudes and experience among editors, authors and reviewers. From this we learn that it is not so much the opening up of the reviewers' identity which is required, but more transparency in the process itself. Likewise, opening peer reviews to readers of the articles might provide an incentive for conducting such reviews in periods of constant work overload and 'reviewer fatigue'. It might also work as an incentive to enhance the quality of reviews.

ii) Switzerland
The Swiss National Science Foundation[91] encourages researchers not only to plan the life cycle of their data, but to treat the DMP as evolving documentation on data practice, considering discipline-specific standards and the criteria of replicability.

Such dynamic DMPs would not only benefit the researchers themselves, but their implementation is also embedded in a positive narrative, that encourages its further development as a research tool which could itself be shared as research output, as is currently being discussed at the Research Data Alliance.[92]

Actions: Encourage the development of an innovative incentive-and-reward system with all relevant stakeholders. Tie Open Science incentives to the reform of the evaluation system. Develop incentives and strong drivers for researchers, research-performing organisations and funders, and governments and policymakers: for instance, create funding bonuses for research institutions that comply with Open Science goals or roadmaps.

4. Visibility of Open Science activities and lack of role models

MLE participants animatedly discussed the problem of poor visibility for Open Scholarship and the problem that currently most Open Science practice is by courtesy of either young researchers or researchers at the margins of the common reward system. Besides the problem that Open Science activities are not acknowledged enough at the moment, we also lack role models, such as prominent senior researchers, research administrators or policymakers, who are taking up the Open Science cause. This would not only help in negotiating Open Access deals with big publishers, as has been the case in the Netherlands and Germany, but it would also showcase greater visibility, trust and courage to potential open scientists and other stakeholders.

Good practice:

i) Awards

Several initiatives have dedicated awards to those conducting Open Science. To name a few: the 'Open Science Prize'[93] is a collaboration between the Wellcome Trust, the US National Institutes of Health (NIH) and the Howard Hughes Medical Institute to unleash the power of Open Content and Data to

[91] http://www.snf.ch/en/theSNSF/research-policies/open_research_data/Pages/data-management-plan-dmp-guidelines-for-researchers.aspx

[92] Research Data Alliance Interest Group Active DMPs: https://www.rd-alliance.org/groups/active-data-management-plans.html

[93] Open Science Prize: https://www.nih.gov/news-events/news-releases/open-science-prize-announces-epidemic-tracking-tool-grand-prize-winner

advance Open Science. To encourage research integrity and transparency in social science, The Rosenthal Prizes for Open Social Science[94] are awarded from BITSS at the Center for Effective Global Action (CEGA) at the University of California, Berkeley[95]. The German Open Science Award Schleswig-Holstein[96] has been presented annually since 2016 to showcase regional achievements.

Actions: Invite senior or prominent players in the research system to promote and advocate for Open Science. Establish visibility measures such as prizes, awards, challenges and dedicated contact points.

5. Open Science and human resources

A key issue in providing adequate rewards, incentives and support (both technical and administrative) for the implementation of Open Science concerns the ways in which research personnel are selected, managed and assessed. Human resources regulations and exemplary practices play a central role in enacting Open Science policies within research institutions, and provide the key reference point for establishing goals and procedures for hiring, job descriptions and staff management. As discussed in chapter 3, the OSCAM matrix provides a good overview on relevant scopes.

Good practice:

i) Human Resources Strategy for Researchers (HRS4R) Award

The HRS4R[97] Award seems particularly useful for fostering Open Science commitment. Most European research institutions are already signatories to the declaration. The strong framework imposed by EU funding initiatives also provides a powerful incentive. Abiding by the HRS4R award, in parallel with the broader ERA roadmap, can provide an overview of what can be changed within institutions and how this fits the European framework.

ii) RPT project

The RPT project[98] is currently examining the review, promotion and tenure (RPT) process in the United States and Canada. The goal is to collect a representative set of tenure and promotion guidelines from over 150 institutions to find out what RPT documents contain. In line with MLE

[94] https://www.bitss.org/lr-prizes/

[95] Berkely Initiative for Transparency in the Social Sciences BITTS: https://www.bitss.org/

[96] https://www.schleswig-holstein.de/DE/Fachinhalte/H/hochschule_allgemein/Downloads/open_science_award_Statut.pdf?__blob=publicationFile&v=2

[97] https://euraxess.ec.europa.eu/jobs/hrs4r

[98] https://www.scholcommlab.ca/research/rpt-project/progress/

participants, the study authors believe that changing these documents will lead to a greater opening up of research.

Actions: Encourage research organisations to review their hiring procedures. Develop guidelines incorporating explicit requirements for Open Science within the possibilities of a research community. Set clear goals and incentivise with awards, bonus funding or visibility measures. Showcase how such measures will make research organisations and whole locations more attractive on the international job markets.

6. Enhancing training and information

MLE participants stressed the significance of providing effective training and clear communications around what Open Science is, how it can be implemented, and what advantages it has for researchers, policymakers, research institutions and civil society as a whole. Many MLE participants pointed to local policymakers' lack of knowledge of often pioneering Open Science activities, and to the significance of advising public officials, including high-level policymakers, on the advantages and practical implications of Open Science, which is crucial for its adoption within national policy. Training could be based on existing policy documents, with reference to ERA planning and similar options, including this report and others produced by the MLE. Furthermore, besides enhancing the professional development of researchers, it will be crucial to 'train the trainers' to build the basis for a new generation of researchers and to educate reviewers to acknowledge and assess Open Scholarship.

Countries need to develop adequate and coordinated sources of information and training programmes, building on existing resources (such as OpenAIRE and the Open Science Monitor maintained by the European Commission). Participants also noted that the EU Communication on Open Science is currently too complex and confusing, even contradictory at times (for example, recent copyright law fostered in the Digital Single Market Directive was discussed as potentially at odds with Open Science policies). The available websites are not clearly structured and more work could be done to point out the practical implications of European Open Science policies.

Good practice:

i) Leiden University

Leiden University promotes and supports Open Science through its Centre for Digital Scholarship.[99] Besides courses on Open Access and research data management, the centre is a contact point for researchers' questions. It also provides guidelines and checklists, e.g. for issues of text and data

[99] https://www.library.universiteitleiden.nl/research-and-publishing/centre-for-digital-scholarship

mining. Furthermore, it promotes exchange among researchers both locally and internationally.

ii) FOSTER e-learning portal

Researchers train researchers is the approach of the FOSTER e-learning portal.[100] On this platform, training resources for Open Science are created or brought together. FOSTER also offers local training and education on all aspects of Open Science and even provides co-funding of community-driven training events. It also sets up good and lively fora and webinars for discussions.

Actions: Create a broad Open Science training agenda encompassing all relevant stakeholders for the professional development of researchers and research administrators, awareness of policymakers, and advanced training for educators and reviewers. Improve and harmonise points of information with clear structures and contact points.

7. Coordination and mobilisation

Member States vary significantly in the ways in which they develop and implement science policy and research management, particularly the impact and visibility of bottom-up initiatives on top-down policy at government level. The implementation of Open Science calls for both international and local coordinated action. On national and European levels, the ERA roadmap might serve as a best reference for coordination. Furthermore, in all the participating countries, bottom-up initiatives are already providing or could be used as platforms and venues for relevant debate. The European Commission also regularly sponsors international meetings, conferences, projects (such as OpenAIRE) and initiatives (like the EOSC) within which the implications of Open Science policies and avenues towards implementation can be discussed across national boundaries. Yet, the MLE has shown that there is relatively little interaction among national governments over how Open Science can be implemented and coordinated.

Good practice:

i) ERAC

The ERAC Standing Working Group for Open Science and Innovation[101] provides an excellent venue for European Member States and Associated States to discuss and coordinate. Another important grouping is the senior National Academies of Science with the junior National Young Academies, which typically includes representatives from all research disciplines and

[100] FOSTER: https://www.fosteropenscience.eu/

[101] http://www.consilium.europa.eu/en/council-eu/preparatory-bodies/european-research-area-innovation-committee/

fields. National Young Academies, together with the Global Young Academy, have proved to be highly engaged in Open Science activities and a very useful platform for consultation on how current changes in the research system are likely to affect researchers on the ground, as well as their outputs and engagement with wider society.

ii) Sweden

Sweden is cooperating closely with the Swedish Young Academy to set up its national Open Science agenda. At present, the National Library of Sweden runs the national coordination task for Open Access and the Swedish Research Council coordinates Open Research Data. A number of working groups are working on national guidelines, which will then be used for recommendations to the government. All main stakeholders are represented in the advisory group and in the five working group (HEIs, funders, researchers, etc.).

Actions: Increasing interaction among countries helps to tackle and distribute efforts and costs related to Open Science implementation, and to support the long-term sustainability and resilience of repositories and data infrastructures. Participation in international Open Science activities such as OpenAIRE creates strong networks and provides resources for the development of policies, infrastructure and tools. Involvement of all relevant local stakeholders in platforms or working groups is essential for the creation of concerted action and a national agenda.

8. Costs

Open Science implementation is expensive, both in terms of the infrastructures required and the human resources and specialist expertise that must be developed, mobilised and maintained to support researchers in this endeavour. Many MLE participants are worried that money going to Open Science is being taken from other places, most often research budgets, which may damage science by further reducing the already small amounts of public spending devoted to it. Furthermore, with infrastructure projects such as the EOSC, expenses are not yet determinable. Estimations of costs must be made for the first time and compared with other regions and partners.

There are several responses to these concerns, which are listed here as 'good answers':

- While potentially disruptive to scientific productivity in the short term, Open Science is likely to boost the efficiency, productivity and impact of research in the long term, thereby justifying the expense.

- Research budgets devoted to scientific publishing and communication will be better deployed as they are now used to sponsor publishing venues that are Open Access.[102]

- Money spent on Open Science infrastructure is not only an investment in openness, but also a way to tackle the pressing general issue of data storage and communication, which is affecting R&I efforts as a result of the latest advances in big data and digitalisation (and regardless of the Open Science agenda).

- A crucial question for Member States is whether the services and technologies deployed to provide digital support for research efforts should be fully privatised (as in the use of Amazon or Google cloud services, or Elsevier's CRIS), or whether public entities should support their own services, as envisaged by the EOSC. The latter option would enable research outputs to remain public goods, available to all in a transparent and regulated way, and make publicly funded science less dependent on the pricing models determined by private companies. However, non-commercial infrastructure is vital to preserve the openness of knowledge and methods. Big Deal research infrastructures could lead to undesirable monopolisation effect across the whole scientific workflow[103]. A major burden to achieving this is the problem of pooling resources across borders. Therefore, the EU and its partners have to develop common funding mechanisms. For example, one good approach is The Global Sustainability Coalition for Open Science Services (SCOSS).[104]

- Building upon infrastructure that already exists – or is being developed – is a priority for large countries, where setting up a national infrastructure is costly and significantly long term. This is also a solution for small countries or countries where the national budget for research is at the minimum, as they gain from the synergies of international platforms (see also MLE Thematic Report 4, pp.13-14). This is particularly important in the context of the EOSC.

Actions: Shift perspectives on collaborative investments and governance structures of national and international initiatives. Based on precise mapping of spending, budget ahead for available funding for the transition. Aim for cost transparency and adaequate indicators,which allow the constant monitoring of public spending on Open Science.

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[102] This option must be evaluated in relation to the public funding available for research in each country, as it may prove problematic particularly where public spending is barely enough to cover researchers' salaries. Negotiations around Open Science budgets may present an opportunity for each country to reconsider and increase public investment in R&I, particularly given the social and economic advantages likely to be created by Open Science activities (European Commission, 2018d).

[103] http://www.sr.ithaka.org/publications/big-deal-research-infrastructure/

[104] http://scoss.org/

9. Tackle the role and functions of publishing

MLE participants frequently pointed to public debate on the role of publishers in scientific governance. Most publishing procedures have been taken over by commercial publishers, and more will follow with a growing need for services to handle big data and communication. Furthermore, costs and conditions of contracts can hardly be monitored due to non-transparent procedures. It is therefore vital that government officials or other representatives in charge of negotiations with publishers are aware of Open Science mandates and attempt to implement them in their future contracts.

Many MLE participants noted the potential of Open Science for enhancing the visibility of research carried out in languages other than English. Since indexes such as the Web of Science provide an incomplete and unreliable overview of international research outputs and are language biased, national Open Access and Open Data repositories that are indexed in English language can make research available to a much larger pool of researchers and industry.

Publishing research outputs other than text-based results requires other types of services. Stakeholders need to discuss the new requirements and co-create platforms that meet these requirements while retaining the spirit of openness and complying with open licences and scholarly commons. It is important to realise that commercial publishers also provide proprietary platforms for discovery and workflow systems, as well as the implementation of CRIS (Current Research Information Systems). MLE participants were concerned that a strong dependency on such platforms could lead to new knowledge monopolies.

Another big problem is the intertwining of commercial publication databases with indicators for research evaluation. Some MLE countries are trialling systems that link Open Access repositories for research outputs with researchers' evaluation. This link between publishing and evaluation strategies is promising in several respects: it provides a strong incentive for researchers to deposit all their results in an Open Access repository; it reduces the administrative burden on researchers; and it reduces the administrative burden on research institutions and funding bodies which can rely on one system for the acquisition of data on research productivity instead of having to develop and manage their own systems.

Good practice:

i) Norway

Norway has a fully integrated non-commercial Current Research Information System. This national database – CRIStin[105] – also provides evidence for the performance-based funding system. ORBi at the University of Liège has

[105] www.cristin.no/english/

already been mentioned above. The University of Liège's rector and the Open Access team made a considerable effort with communication and awareness-raising in order to facilitate its widespread adoption. The University of Bern hosts the publishing platform BORIS[106] used to submit publications and data both for Open Access and for evaluation.

ii) Croatia

The Croatian scientific bibliography CRSOSBI[107] contains more than 450 000 bibliographic records, allowing scientists to archive full-text articles in Open Access. Even though it has yet to be implemented for the purposes of evaluating Croatian researchers, it has already increased the visibility of Croatian research to the world.

Actions: Reconnecting publishing and evaluation via national efforts is a key step in the implementation of Open Science, striving for more visibility, accessibility and better assessability of a broader diversity of research outputs. Open Access repositories enhance the visibility of research and offer a variety of potential interfaces for research evaluation and performance monitoring. Non-commercial CRIS systems enable collection and monitoring without intermediate and commercial data dealers. The role and function of publishers needs to be scrutinised, new Open Access publishing models – at national level or on international platforms – need to be incentivised, based on cost transparency. The activities of commercial publishers need to be aligned with governmental policy on Open Science, as any misalignment makes it hard to implement changes in the publishing system as a whole.

10. Legal security

According to MLE participants, a big obstacle in researchers' uptake of Open Science is the insecurity around the legality of Open Science practices. On the one hand, there is the issue of privacy of research subjects and protection of sensitive data, which needs to be taken into account when deciding how to make scholarship more open. This must be tackled explicitly in training and education. On the other hand, there are often no clear institutional policies around Open Science, and certainly a lot of confusion in national and EU legal frameworks concerning the problematic interaction of intellectual property regimes and Open Science. For example, many scholars are not sure whether they have the right to secondary publication, even though they have signed a contract with a commercial publisher. Scholars are also typically supported by multiple funding sources, and collaborate with several networks subject to different norms around intellectual property, which complicates their understanding of what they are expected to do and by whom. Providing legal security would certainly

[106] https://boris.unibe.ch/

[107] https://bib.irb.hr/

serve as a strong incentive for researchers who are sceptical about adopting open practices.

Good practice:

i) France

The government of France is taking practical steps, most notably by implementing a new legal framework that enables researchers to publish their last preprint wherever they want, thereby giving legal security to Green Open Access publishing and secondary publication or preprints. France is now developing a communication strategy to explain to stakeholders how to use this framework. A similarly new legal framework is also under preparation in Belgium.

ii) Portugal

Portugal involves IPR management agencies in the discussion of the national Open Science agenda.

Actions: Clarifying how intellectual property legislation intersects with Open Science provisions will help with the implementation of Open Science. Organisations have to develop accessible open policies and provide points of contact for questions related to the entanglements of IPR and Open Science. Training should be provided on the creation of knowledge commons (also relevant for OER) within intellectual property regimes.

5.2 Priorities

It is vital that the implementation of Open Science is guided by clear goals and broad consent of relevant stakeholders. From the discussions during this MLE, Leonelli has compiled a set of priorities for the implementation of Open Science at the national level, which have been adapted and widened for this report (European Commission 2018d, p3-4):

- **Achieving Open Access to publications** is regarded as a necessary basis for all other Open Science activities

- **Involve researchers and research organisations in all aspects of Open Science implementation** – thereby making sure that relevant stakeholders are fully engaged in the process – and creating venues for regular meetings and discussions

- The management of Open Science implementation needs **leadership and clear responsibilities**. Coordination and planning of implementation will entail co-design efforts by all relevant stakeholders requiring well-defined goals, responsibilities, clear points of contact and regular venues for discussion and monitoring progress

- **Combining forces**: planning and implementation of Open Science should include alignment with or embedding within already established activities, such as the European Research Area ERA Roadmap

- **Coordinate with European governance and other countries**: push for and align with clearly formulated Open Science policies, goals and infrastructure at the European level, which would function as role models and guidelines for what these countries need to contribute; allying with other governments or international initiatives will facilitate testing and the evaluation of new measures

- Embracing other aspects of Open Science, such as **Open Research Data, Open Methods and Open Educational Resources** entails firm strategies, close collaboration among relevant stakeholders and continuous investment in transparent and sustainable structures for communication, as these aspects have more disruptive potential and require careful management within diverse socio-technical cultures; exchange across the sub-fields of Open Science is vital

- Highlight drivers of Open Science and develop **incentives and rewards** for all stakeholders, including researchers, research organisations, funders and policymakers, as presented in chapter 3 of this report

- Foster and encourage the development of skills by **offering and rewarding adequate training of all stakeholders** (including peer reviewers and other assessors); the scope of trainings includes: Open Access publishing, data sharing and management, research services, open education resources and open teaching, funding opportunities, licensing and IPR, long-term preservation, tool development, open leadership, etc.

- A **shift to sets of multiple indicators for research assessment**, including metrics for openness, as suggested by leading experts,[108] involves decision-making on the grounds of more complex information and requires a break with existing assessment systems for many countries; furthermore, this entails planning periods of elaborate testing and training of assessors which should be organised at supra-national levels

- Working with existing research **infrastructures, enhancing their open capabilities**, encouraging collaboration, and incentivising their use; creating pilot national use cases for the EOSC, testing models of governance and cooperation

- **Monitoring investments**: an assessment of costs and the infrastructure required to guarantee the long-term sustainability of the Open Science system must be carried out, and budgets redirected accordingly. This

[108] e.g. Hicks et al., (2015); Nichols & Twidale, (2017)

requires a revision of current research information systems (e.g. adding relevant criteria for collecting data on Open Science practices)

- **Clarify the legal framework** relating to Open Science, particularly IPR regimes linked to research outputs (including data, techniques and software); highlight potential synergies of knowledge commons and commercial interests

- **Prioritise public engagement** in Open Science activities, including Citizen Science initiatives, engaging members of the public in the design of research questions and assessment, and the inclusion of diverse sources of expertise in academic research and education

- Enhance research outputs and quality, thereby making research within each country more competitive by **improving the visibility of researchers and collaborations with industry** both nationally and internationally; frame Open Science as 'excellent science' and 'high research quality', in terms of integrity, accountability, participation, and impact-literacy

- **Support early-career researchers** and prevent the brain drain: early-career researchers are most directly affected by transitions in assessment and guidelines for Open Science and most vulnerable to evaluations that ignore open practices, and therefore will benefit from rewards directed to collaboration, data curation, etc. The holistic improvement of working conditions and research environments can help to prevent the brain drain (both dropping out of the research system, and migrating to other countries) and attract an influx of top talents from abroad.

- Close monitoring of the transition to Open Science makes it possible to **address emerging concerns** in a timely and efficient manner: it is crucial to use the transition to Open Science as an opportunity to hold regular discussions on scientific governance with relevant stakeholders, including on the needs of different research fields, cultural and language issues, and infrastructural demands based on cost transparency and open assessment procedures.

5.3 Roadmap for Open Science[109]

This section proposes a roadmap for the implementation of Open Science at the national level, comprising a list of stages involved in this process, examples of relevant activities for each stage, and a tentative time plan for achieving each stage. This Open Science Roadmap, which is detailed in Table 1, follows the general rationale for Open Science implementation provided in the EU Report on Open Science Rewards (EU Working Group on Open Science Rewards, 2017). This involves: 1) the removal of barriers through targeted investment and debate; 2) the provision of practical support and information on Open Science

[109] This whole section is reproduced with slight changes from European Commission, (2018d), pp.17-19.

initiatives; 3) the provision of incentives to broaden Open Science adoption among stakeholders; and 4) the enforcement of Open Science practices in research evaluation procedures.

The roadmap includes several fundamental steps to be taken:

- The establishment of **systematic mapping exercises**, detailing existing initiatives in each country and providing tools to take advantage of them at the international level, will be highly informative to future Open Science activities. We are facing considerable variation in the **types of actors that are spearheading Open Science** across countries, and in the attitudes of research communities, institutions and public bodies towards Open Science engagement. In some cases, efforts are championed by science academies (senior and/or junior); in others, by universities and/or funding bodies; and in others, by libraries and data infrastructures. It is imperative that countries develop mechanisms to identify and take advantage of existing strengths, as well as to encourage participation by the general public and stakeholders who have not yet engaged in Open Science.

- The **transition to Open Science needs to be closely monitored**, with attention paid to cost assessment and the evaluation of uptake, benefits and potential risks for each country and relevant stakeholders. Social and ethical implications of Open Science implementation need to be discussed, scrutinised and tackled throughout the development of Open Science initiatives and related infrastructures and tools.

- Public engagement and involvement of Citizen Science initiatives need to be integrated into Open Science policy and actions, with elaborated communication strategies targeted at **enhancing the visibility of Open Science and promoting understanding of its significance** and societal impact. Targeted media campaigns could be useful in that respect.

- **Discussion venues** through which countries can regularly share insights, compare policies and experiences, and coordinate actions are crucial. An example of such a venue is the ERA Standing Group on Open Science and Innovation, whose existence is, however, not widely known and whose future existence and effectiveness currently depend on the efforts of individual participants. Groups of this kind are also a key platform where countries can discuss international initiatives such as the EOSC, and coordinate their contributions to the successful establishment and long-term maintenance of such international efforts. Similarly, such discussion venues have to be established at the national level to bring together all relevant stakeholders.

Table 3 provides a synoptic view of the various stages for implementing Open Science at the national level. Given the large diversity in the stages at which each country finds itself, and the specific institutional and regulatory set-up within each nation or region, the examples provided as possible activities for each stage are only indicative. Each country will need to devise its own Open Science strategy, tailoring these suggestions to its specific situation.

Furthermore, the time plan for implementing these stages will depend largely on each country's specific situation. Therefore, the following should be seen only as a proposal around which to conduct discussions. It is perfectly possible to envisage these stages happening in a different order, or simultaneously, depending on the resources and priorities in each case. The intention is to provide a blueprint that could be used particularly by countries that are still at the beginning of their implementation of Open Science activities. The aim is to guide their discussions and stimulate the development of a national agenda (for countries where this has yet to be established) or monitor progress (for countries where Open Science is already being supported).

Table 3: National Open Science Roadmap for the implementation of Open Science at the national level, comprising a list of stages involved and examples of relevant activities for each stage

Stage	Target	Example of relevant activity
Map	Identify key stakeholders and Open Science champions	Launch mapping exercise to identify key stakeholders and potential contributors to Open Science activities Launch national consultation to capture ongoing Open Science activities and identify Open Science ambassadors and role models Organise Open Science round tables and venues for discussion
Plan	Devise a national strategy through consultation with stakeholders	Produce a clear, widely available national agenda for Open Science Promote the agenda among relevant stakeholders and the general public, including through media campaigns Include Open Science discussion and monitoring in ERA Roadmap meetings Ensure that the development and implementation of a national Open Science agenda is transparent, with easily accessible information sources that document the steps being taken
Incentivise	Change reward system to incentivise all aspects of Open Science, especially Open Data, Open Methods, Open Education	Adopt the OS-CAM Guide to research evaluation Establish a funding-allocation system that rewards Open Science activities, such as Open Data, Open Education and public engagement Establish Open Science prizes and awards Promote transparent assessment criteria and open scientometric databases
Promote	Encourage critical and informed	Require DMPs for all publicly funded projects

Stage	Target	Example of relevant activity
	thinking around the implementation of Open Data	Establish training in data ethics and data management for researchers, administrators and research institutions
Support	Participate in international initiatives to develop and maintain Open Science infrastructures	Identify and support key data repositories and data management tools (nationally and internationally) Contribute to the EOSC and international OA publishing platforms Initiate cross-country cooperation and dialogue
Implement	Implement strategy, starting from Open Access	Set up national repository for Open Access journals or preprints Devise and implement a legal framework which enables and supports Open Access publishing and Open Research Data policies
Monitor	Monitor and tackle emerging issues as they arise, in consultation with stakeholders	Set up regular meetings among stakeholders to check on Open Science transition and outcomes Create monitoring and documentation systems for Open Science activities and track the availability of relevant tools and training in libraries, research institutions and funding agencies Establish clear points of contact and accountability for any emerging problems Promote cost transparency

The roadmap proposed in this report must be discussed in detail by stakeholders in each country, and with national governments to consider their response and strategies vis-à-vis European Open Science policies. The focus of this indicative roadmap is on the topics in this MLE, starting with Open Access to publications, Open Research Data and related infrastructures, and on the necessary changes in the incentive and reward system, since these areas have been identified as the next priorities. However, that is not to say that Open Educational Resources or Citizen Science should not be considered. Depending on the situation in each country, they could even be drivers for Open Science implementation.

Nevertheless, a National Open Science Roadmap must be considered in relation to (and aligned closely with) the ERA Roadmaps developed by ERA states, and integrated into those very discussions to ensure coherence across government departments and international cooperation (and avoid duplication of efforts). Section 5b on 'Optimal circulation and transfer of scientific knowledge –

Promoting Open Access' is of direct relevance here, although all other sections of the ERA Roadmap are relevant to the implementation of Open Science in its comprehensive mode.

The National Open Science Roadmap also builds on the much more detailed 'Roadmaps on Open Access and Open Research Data' developed by the League of European Research Universities (LERU) in 2011 and 2013 (LERU 2011, 2013). Finally, the National Open Science Roadmap builds on the set of incentives and rewards identified in the MLE Thematic Report 3, which are reported in Table 4.

Table 4 : Synoptic view of the approaches to incentivising and rewarding Open Science activities discussed in the MLE Report on Incentives and Rewards for Open Science Activities (Leonelli 2017)

	OS-CAM research evaluation	**OS training provision and education resources**	**Shifts in citation and authorship**	**Long-term sustainability**	**Open Science role models**	**Responsible innovation and public engagement**	**Transparency and accountability**	**International coordination and science diplomacy**
Required conditions	Overhaul of evaluation procedures at research institutions and funding bodies	Resources and personnel to provide training locally and nationally	Overhaul of evaluation procedures and publishing format	Complex coordination among stakeholders and long-term commitment	Establishing criteria for successful Open Science within each field; buy-in from learned societies and science academies	Rewards for social interaction and non-traditional outputs; co-design of research with relevant stakeholders	Systems for tracking, visualising and discussing the organisation, outputs and funding of research	Clear points of contact and communication channels/venues to debate Open Science implementation
Pros	Most important set of incentives and rewards for researchers	Enables researchers to practise Open Science effectively; produces innovative education tools	Recognition of currently invisible efforts to support Open Science	Crucial incentive for researchers; ensures the long-term fruitfulness of current investments	Exemplifying advantages of Open Science, and ways to successfully implement it; enhancing international status of research institutions; relatively inexpensive	Embedding of research in society, towards devising ethical and responsible solutions to global challenges	Improved documentation and scrutiny of research processes and resources; better reproducibility of results and evaluation of accountabilities for given outcomes	Enhanced international visibility, networking and diplomatic relations across institutions and nation states

	OS-CAM research evaluation	OS training provision and education resources	Shifts in citation and authorship	Long-term sustainability	Open Science role models	Responsible innovation and public engagement	Transparency and accountability	International coordination and science diplomacy
Cons	Time-intensive evaluation procedures	Investment in training provision and related staff; needs to be included in researchers' workload	Requires new policies tailored to each publication venue	Complex coordination among stakeholders and long-term financial support	Mobilising learned societies and science academies to actively promote Open Science	Risk of less investment in fundamental research; greater accountability for all research activities (including privately funded ones)	Increased administration and more investment in data analysis and qualitative assessments	Increased national research budgets; need for coordination between science and foreign policy
Challenges	Administrative, cultural and financial	Administrat ive, financial and cultural	Cultural and logistical	Logistical and financial	Logistical	Cultural, administrative, logistical, financial	Administrative, cultural, logistical	Administrative, logistical, political
Who implements this? (note: researchers are always involved)	**Research institutions, funding bodies, researchers**	**Funding bodies, libraries**	**Research institutions, funding bodies, editors, publishers**	**EU, national governments, research institutions, libraries**	**National governments, funding bodies, learned societies**	**Funding bodies, research institutions, EU, national governments**	**Funding bodies, research institutions, EU, national governments**	**National governments, policymakers, research managers.**

5.4 Conclusions and next steps

This report:

- Reflects the mutual and peer-supported learning to support countries in **designing, implementing and/or evaluating different approaches and instruments** for the realisation of Open Science

- Addresses first and foremost **policymakers**, but also decision-makers in research management, research services and funding organisations

- Identifies **good practices**, lists **priorities** and outlines potential **courses of action** for the implementation of Open Science

Follow-up ativities

Participants expressed high interest in:

- Designing a sustainable dissemination strategy for the outcomes of the MLE

- A dedicated MLE on Open Infrastructures (such as the EOSC) and Open Research Data policies to discuss the co-design of national use cases, cost estimations, governance models, change management and so forth. How much does it cost for a country to have the critical mass of data infrastructures ready for the EOSC? How much does FAIR data cost? This could be the central question for a follow-up MLE. In line with developments in EOSC and e-infrastructure working groups, delegates from countries could develop use cases and scenarios together, build on existing experiences, and discuss benefits and challenges of federated infrastructures.

- The establishment of an expert group/working group on 'Open Leadership' based on the outcomes of this MLE but also of the expert working groups on skills and rewards to better address the need for role models, pioneers and pilot activities and scenarios.

- A review meeting after one year, so as not to lose momentum and to communicate and reflect achievements, hindrances and progress made after one year.

Conclusions and outlook for participating countries

"There can be no mission-oriented approach to research and innovation without Open Science" (MLE participant)

- **The implementation of Open Science needs a bigger picture.** We need to discuss the roles and functions of science in society right now, taking more stakes in setting the agenda for science and innovation. In that regard, every mission-oriented approach needs Open Science and participatory settings to succeed. It will thus be vital for the development of future R&I policies to highlight this position, whether at the national or European level.

Developing coherent communication strategies and harmonising information sources (e.g. from ERA and Open Science) will thus be of the utmost importance both at the national and EU level.

- **National strategies for the implementation of Open Science are essential.** How can we bring national science and innovation agendas together with effective change management? We need to understand the links between Open Science policies and general STI policies, as the effects will be cross-cutting. Too many parallel activities, strategies and agendas need to be converged. Being a part of the EU Treaty, ERA should be the central platform for developing national Open Science strategies. However, ERA policies, ERA roadmaps and ERA National Action Plans should be reviewed through the lens of Open Science. Furthermore, ERA comes with a robust monitoring system to be broadened to integrate relevant Open Science criteria.

- **We need Open Science champions and role models.** Therefore, we need to consult with all stakeholders across all governance levels on how to advocate skills and training for Open Science, raise awareness of senior representatives of policy and academia, and incentivise Open Leadership.

- **Open Science is enhancing knowledge markets and improving innovation.** There are manifold shades of openness. Open Science is not an 'all or nothing game'. The synergies of scholarly commons and the commercial exploitation of research outputs need a systematic review and substantial evidence. Therefore, it will be vital to rethink reusability and its impact on innovation policies. What specific effects can be observed, what benefits do we expect for SMEs? Case studies and pilot programmes are needed at the national level to explore the benefits and challenges.

Conclusions and outlook for the European Commission

"We believe the progress of EU Member States in implementing Open Science shall be supported at the EU level, providing a basic source of information, pilot projects, best practices, role models as well as adequate guidelines and training for the policymakers, to enable and support Member States in making proper, EU-harmonised steps in that direction." (MLE participant)

Throughout the course of the MLE, participants highlighted the crucial role of the European Commission in guiding and coordinating the process of Open Science implementation. The amount of expertise already accumulated – e.g. through the work of several expert groups, stakeholders mechanisms such as the Open Science Policy Platform, experiences with Open Access and Open Research Data pilots – should be made widely available.

In order to take advantage of the expertise and intelligence gathered around Open Science implementation, it is essential that tools such as the Open Science monitor and the various reports produced on aspects of Open Science are transformed into service tools and templates for the design of policies and strategies.

MLE participants call on the European Commission to continue its important role in fostering Open Science by:

- making Open Science provisions a key part of FP9;
- coordinating infrastructure provision, training and the development of common standards (as in the current initiatives around the EOSC);
- strenghtening information exchange and knowledge transfer about Open Science across European organisations;
- devising innovation policies based on the development of scholarly commons and clarifying how intellectual property and copyright legislation intersects with Open Science mandates;
- promoting European Open Leadership.

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The transition to Open Science represents a policy challenge, which is best tackled in close cooperation with relevant actors both on local and international scale. This report builds on the exchange of experiences and mutual learning of 13 countries: Armenia, Austria, Belgium, Bulgaria, Croatia, France, Latvia, Lithuania, Moldova, Portugal, Slovenia, Sweden and Switzerland. It provides an overview of various challenges of Open Science implementation across Europe as discussed throughout several meetings in 2017. Its focus is on three topics, all of which are key elements of the European Open Science Agenda: 1) The potential of altmetrics – alternative (i.e. non-traditional) metrics that go beyond citations of articles – to foster Open Science; 2) Incentives and rewards for researchers to engage in Open Science activities; 3) Guidelines for developing and implementing national policies for Open Science. Addressing policymakers and decision-makers in research management, research services and funding organisations this report identifies good practices, lists priorities and outlines potential courses of action for the best possible transition to Open Science.

Studies and reports

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