

Deutsche UNESCO-Kommission, 18. Dezember 2020

Konsultationsfassung des ersten Entwurfs der "UNESCO-Empfehlung zu Open Science"

Sehr geehrte Damen und Herren,

unten finden Sie den ersten Entwurf der UNESCO-Empfehlung. Dieser Völkerrechtstext soll bis Herbst 2021 finalisiert sein, so dass die Empfehlung durch die UNESCO-Generalkonferenz verabschiedet werden kann. Der erste Entwurf wurde formuliert nach Dutzenden von Konsultationen mit wichtigen Akteuren aus der Wissenschaft und Konsultationen in allen Weltregionen. Aus Sicht der Deutschen UNESCO-Kommission hat der erste Entwurf der Empfehlung bereits eine sehr erfreuliche Qualität.

Sie haben **zwei Möglichkeiten, sich hier einzubringen**.

1. Sie können jegliche Kommentare **bis 31.12.2020 direkt an die UNESCO** zurückmelden; nutzen Sie dazu die Adresse openscience@unesco.org. Idealerweise senden Sie uns bitte eine Kopie Ihrer Kommentare an moeller@unesco.de.

2. Für eine **gesammelte Kommentierung aus Deutschland** bitten wir Sie **bis zum 5.1.2021 (18 Uhr)** um Ihre Kommentare zu dem Entwurf an moeller@unesco.de. Wir bitten Sie darum, sich auf den Text *nach* der Präambel und auf folgende Punkte zu konzentrieren:

- **Erhebliche fachliche Kritik:** Welche Absätze oder welche Formulierungen halten Sie für **fachlich sehr problematisch**? Bitte unterfüttern Sie Ihre Kritik mit geeigneten Argumenten. Umgekehrt bedeutet dies, dass wir Sie bitten, **keine stilistischen Optimierungen** vorzuschlagen. *((Bitte betrachten Sie das Format der Empfehlung als gesetzt – einzelne Passagen des Formats können Sie natürlich kritisieren (z.B. halten wir Absatz 12 zu den Zielgruppen für überflüssig).))*
- **„Rote Linien“ im Eigeninteresse der EU, Deutschlands oder Ihrer Institution:** Welche Absätze oder welche Formulierungen halten Sie für **politisch sehr problematisch**? Bitte unterfüttern Sie Ihre Kritik mit geeigneten Argumenten.
- **Fehlstellen:** Welche Themen fehlen in dem Entwurf? An welcher Stelle sollten sie wie berücksichtigt werden? Bitte machen Sie einen konkreten Formulierungsvorschlag.
- **Unvollständige Schlussfolgerungen:** Welche Argumentationslinien sind nicht schlüssig, weil wichtige Aspekte nicht oder unzureichend abgebildet sind? Bitte machen Sie einen konkreten Formulierungsvorschlag.

Bitte benutzen Sie für Ihren Beitrag zur **gesammelten Kommentierung aus Deutschland** für Änderungs- und Ergänzungsvorschläge den Änderungsmodus von Word; für unterstützende Argumentationen nutzen Sie bitte Word-Kommentare. Zwischen 6. und 8. Januar wird die Deutsche UNESCO-Kommission mit dem Auswärtigen Amt und dem Bundesministerium für Bildung und Forschung die gesammelte Kommentierung abstimmen.

Mit freundlichen Grüßen Lutz Möller, Deutsche UNESCO-Kommission

First draft of the UNESCO Recommendation on Open Science

Preamble

The General Conference of the United Nations Educational, Scientific and Cultural Organization (UNESCO), meeting in Paris XX November 2021,

Recognizing the urgency of addressing complex and interconnected environmental, social and economic challenges for the people and the planet, including poverty, health issues, access to education, rising inequalities and disparities of opportunity, natural resource depletion, loss of biodiversity, land degradation, climate change, natural and human-made disasters, spiralling conflicts and related humanitarian crises;

12
13 *Acknowledging* the vital importance of science, technology and innovation to respond to these challenges
14 by providing solutions to satisfy human needs, improve living standards and human well-being, advance
15 environmental sustainability, foster sustainable social and economic development and promote
16 democracy and peace;

17
18 *Further acknowledging* the opportunities and the potential provided by the expansion of information and
19 communication technologies and the global interconnectedness to accelerate human progress, to bridge
20 the digital divide and to develop knowledge societies;

21
22 *Noting* that the global COVID-19 health crisis has proven worldwide the urgency of access to scientific
23 information, sharing of scientific knowledge, data and information, enhancing scientific collaboration and
24 science- and knowledge-based decision making to respond to global emergencies and increase the
25 resilience of societies;

26
27 *Committed* to leaving no one behind with regard to access to science and benefits from scientific
28 progress by ensuring that, for example, when a safe and effective vaccine or treatment for COVID-19 is
29 developed, it is produced rapidly on scale and the data, scientific knowledge and methods needed to
30 produce it are openly available for all countries;

31
32 *Recalling* that one of the key functions of UNESCO, as stipulated in Article I of its Constitution, is to
33 maintain, increase and diffuse knowledge by encouraging cooperation among the nations in all branches
34 of intellectual activity, including the exchange of publications, objects of artistic and scientific interest and
35 other materials of information and by initiating methods of international cooperation calculated to give
36 the people of all countries access to the printed and published materials produced by any of them;

37
38 *Affirming* the principles of the Universal Declaration of Human Rights, which state that all people have
39 the right to freely to participate in the cultural life of the community, to enjoy the arts, and to share in
40 scientific advancement and its benefits (Article 27);

41
42 *Also affirming* the 2007 United Nations Declaration on the Rights of Indigenous Peoples, which recognizes
43 the rights of indigenous peoples to maintain, control, protect and develop their traditional knowledge and
44 cultural expressions, as well as the manifestations of their sciences, technologies and cultures;

45
46 *Building on the basis of* the UNESCO Recommendation on Open Educational Resources, adopted by
47 the UNESCO General Conference at its 40th session in 2019, and the UNESCO Recommendation on
48 Science and Scientific Researchers adopted by the UNESCO General Conference at its 39th session
49 in 2017;

50
51 *Recognizing* that science under the aforementioned Recommendation on Science is a global common
52 good and, by the Universal Declaration of Human Rights and the International Covenant on Economic
53 Social and Cultural Rights, is also an internationally-agreed fundamental human right which should be
54 accessible to and bring benefit to all humankind;

55
56 *Recognizing* that Open Science originated as a movement to transform scientific practice to adapt to the
57 changes, challenges, opportunities and risks of the 21st century digital era and to increase the societal
58 impact of science in response to the growing and complex global issues facing humanity;

59
60 *Further recognizing* the significant available evidence for the economic benefits and substantial return on
61 investment associated with Open Science practices and infrastructures, which enable innovation,
62 dynamic research and economic partnerships;

63
64 *Considering* that, produced in an open, collaborative and inclusive way, Open Science, as a source of
65 knowledge that is accessible, transparent, verifiable and subject to scrutiny and critique, is a more
66 efficient enterprise that improves the quality of science and thereby the reliability and the
67 commensurability of the evidence needed for robust decision-making and policy;

68
69 *Further considering* that the collaborative and inclusive characteristics of Open Science allow new social
70 actors to be actively involved in scientific production, democratizing knowledge, addressing existing
71 systemic inequalities and enclosures of wealth, knowledge and power and guiding scientific work towards
72 solving problems of social importance;

73
74 *Acknowledging* that greater access to scientific inputs and outputs can improve the effectiveness and
75 productivity of the scientific systems by reducing duplication costs in collecting, creating, transferring
76 and reusing data and scientific material, allowing more research from the same data, and increasing the
77 social impact of science by multiplying opportunities for local, national, regional and global participation
78 in the research process, and opportunities for wider circulation of scientific findings;
79

80 *Considering* that Open Science should not only foster enhanced sharing of scientific knowledge but also
81 promote inclusion of scholarly knowledge from marginalized groups (such as women, minorities,
82 Indigenous scholars, non-Anglophone scholars, scholars from less- advantaged countries) and
83 contribute to reducing inequalities in access to scientific development, infrastructures and capabilities
84 among different countries and regions;
85

86 *Recognizing* that Open Science respects the diversity of cultures and knowledge systems around the
87 world as foundations for sustainable development, fostering open and robust dialogue with indigenous
88 peoples and local communities and diverse knowledge holders for contemporary problem-solving and
89 emergent strategies towards transformative change;
90

91 *Acknowledging* the transformative potential of Open Science for reducing the existing inequalities in
92 science, technology and innovation and accelerating progress towards the implementation of the
93 Agenda 2030 and the achievement of the Sustainable Development Goals and beyond;
94

95 *Taking fully into account*, in the adoption and application of this Recommendation, the great diversity of
96 the laws, regulations and customs which, in different countries, determine the pattern and organization
97 of science technology and innovation:
98

- 99 1. Adopts the present Recommendation on Open Science on this day of ... November 2021;
100
101 2. Recommends that Member States apply the provisions of this Recommendation by taking
102 appropriate steps, including whatever legislative or other measures may be required, in
103 conformity with the constitutional practice and governing structures of each State, to give
104 effect within their jurisdictions to the principles of the Recommendation;
105
106 3. Also recommends that Member States bring the Recommendation to the attention of the
107 authorities and bodies responsible for science, technology and innovation, and consult
108 relevant actors concerned with Open Science;
109
110 4. Further recommends that Member States report to it, at such dates and in such manner as
111 shall be determined, on the action taken in pursuance of this Recommendation.
112

113 **I. AIM AND OBJECTIVES OF THE RECOMMENDATION**
114

115 1. Universal access to scientific knowledge, regardless of geography, gender, political boundaries,
116 ethnicity or economic or technological barriers is an essential prerequisite for human development and
117 progress towards planetary sustainability.
118

119 2. Driven by unprecedented advances in our digital world, and mindful of the associated risks,
120 Open Science sets a new paradigm for the scientific enterprise based on transparency, sharing and
121 collaboration, providing access to all outputs of research, adopting new ways of conducting and
122 evaluating research, and including social actors beyond the scientific community in the creation of
123 knowledge and its use for decision and policy-making.
124

125 3. As Open Science turns into a global movement, robust institutional and national Open Science
126 policies and legal frameworks need to be developed by all nations to ensure that scientific knowledge,
127 data and expertise are universally and openly accessible and their benefits universally and equitably
128 shared.
129

130 4. To this end, the aim of this Recommendation is to provide an international framework for Open
131 Science policy and practice that recognizes regional differences in Open Science perspectives, takes
132 into account, in particular, the specific challenges of scientists and other Open Science actors in

133 developing countries, and contributes to reducing the digital, technological and knowledge divides
134 existing between and within countries.

135
136 5. This Recommendation outlines a common definition, shared values, principles and standards
137 for Open Science at the international level and proposes a set of actions conducive to a fair and equitable
138 Open Science transition at individual, institutional, national, regional and international levels.

139
140 6. To achieve its aim, the key objectives and areas of action of this Recommendation are as follows:

- 141
142 (i) promoting a common understanding of Open Science and diverse paths to Open Science;
143 (ii) developing an enabling policy environment for Open Science;
144 (iii) investing in Open Science infrastructures;
145 (iv) investing in capacity building for Open Science;
146 (v) transforming scientific culture and aligning incentives for Open Science;
147 (vi) promoting innovative approaches for Open Science at different stages of the scientific
148 process;
149 (vii) promoting international cooperation on Open Science.

150 151 II. DEFINITION OF OPEN SCIENCE 152

153 7. As per the 2017 UNESCO Recommendation on Science and Scientific Researchers, the term
154 'Science' signifies the enterprise whereby humankind, acting individually or in small or large groups,
155 makes an organized attempt, by means of the objective study of observed phenomena and its validation
156 through sharing of findings and data and through peer review, to discover and master the chain of
157 causalities, relations or interactions; brings together in a coordinated form subsystems of knowledge by
158 means of systematic reflection and conceptualization; and thereby furnishes itself with the opportunity
159 of using, to its own advantage, understanding of the processes and phenomena occurring in nature and
160 society.

161
162 8. The term 'Open Science' refers to an umbrella concept that combines various movements and
163 practices aiming to make scientific knowledge, methods, data and evidence freely available and
164 accessible for everyone, increase scientific collaborations and sharing of information for the benefits of
165 science and society, and open the process of scientific knowledge creation and circulation to societal
166 actors beyond the institutionalized scientific community.

167
168 9. For the purposes of this Recommendation, 'Open Science' means a complex of at least the
169 following key elements:

170
171 (i) **Open Access:** Open access generally involves users being able to gain full and immediate
172 access to and unrestricted use of scientific outputs including scientific publications, data,
173 software, source code and protocols, produced in all parts of the world, free of charge to the
174 user and re-usable. Subject to the users' proper attribution of source and authorship, all users
175 are granted free, irrevocable, worldwide rights to access, copy, retain, use, distribute, transmit
176 and display the work publicly and to make and distribute derivative works, in any medium for
177 any responsible purpose. In the case of scientific publications, the publication and all related
178 scientific outputs (e.g. original scientific research results, raw data and metadata, software,
179 including source code, source materials, digital representations of pictorial and graphical
180 materials and scholarly multimedia material), should be deposited, upon publication, in at least
181 one online repository using suitable technical standards that is supported and maintained by an
182 academic institution, scholarly society, government agency, or other well-established non-profit
183 organization devoted to common good that seeks to enable open access, unrestricted
184 distribution, interoperability, and long-term archiving.

185 (ii) **Open Data:** data that can be freely used, reused and redistributed by anyone, subject only, at
186 most, to the good practice of acknowledgement, attribution and citation. To ensure the
187 openness of data, it is necessary that data and databases, as appropriate, are clearly described
188 as 'in the public domain', assigned a public domain waiver, or an open license. Data should be

189 available in a human- and machine-readable and modifiable format, in accordance with
190 principles of good data governance, such as for example the FAIR (Findable, Accessible,
191 Interoperable, and Reusable) principles. When access to data needs to be restricted for
192 security, privacy or other reasons, it should be in line with paragraph 10 below of this
193 Recommendation.
194

195 (iii) **Open Source/Software and Open Hardware:** open software describes software that is
196 publicly available under an open license that grants others the right to access, modify, expand,
197 study, create derivative works, use and/or share the software and its source code, design, or
198 blueprint. The source code must be included in the software release or made available upon
199 request and the chosen license must allow modifications, derived works, and sharing under
200 equal conditions. Similarly open hardware refers to the design specifications of a physical object
201 which are licensed in such a way that said object can be studied, modified, created, and
202 distributed by anyone providing as many people as possible the ability to construct, remix, and
203 share their knowledge of hardware design and function. In the case of both open software and
204 open hardware, a community-driven process for contribution, attribution and governance should
205 be in place to enable reuse, improve sustainability and reduce unnecessary duplication of effort.
206

207 (iv) **Open Science Infrastructures:** digital infrastructures that are needed to support Open Science
208 and serve the needs of different communities. Open Science platforms and repositories are
209 among the critical Open infrastructures, which provide essential services to manage and
210 provide access to data, scientific literature, thematic science priorities or community
211 engagement. Different repositories are adapted to local circumstances, user needs and the
212 requirements of research communities, yet should adopt interoperable standards and best
213 practices to ensure the content in repositories is appropriately vetted, discoverable and reusable
214 by humans and machines. Some repositories and infrastructure provide 'science ready' data
215 products, sometimes using high-level analytic and artificial intelligence procedures, to support
216 analysis and research in the community they serve. Open Science infrastructures should be non-
217 profit and they should guarantee permanent and unrestricted access to all public.
218

219 (v) **Open Evaluation:** organized assessment of research with highly transparent and participatory
220 peer review process, including possible disclosure of the identity of the reviewers, publicly
221 available reviews and the possibility for a broader community to provide comments and
222 participate in the assessment process. Additionally, to further transparency of the scientific
223 enterprise, Open Notebooks include the opening of the whole research process and insights
224 in every stage. Entire research projects are made openly available from the beginning, granting
225 others access to virtual research workspaces.
226

227 (vi) **Open Educational Resources:** learning, teaching and research materials in any format and
228 medium that reside in the public domain or are under copyright that have been released under
229 an open license, that permit no-cost access, re-use, re- purpose, adaptation and redistribution
230 by others.
231

232 (vii) **Open Engagement of Societal Actors:** Open Science extends collaboration with societal
233 actors beyond the scientific community by opening up practices and tools that are part of the
234 research cycle. In the perspective of developing a collective intelligence for problem solving,
235 including through the use of transdisciplinary research methods, Open Science provides the
236 basis for integration of concerns, values, and world-views of policymakers and practitioners,
237 entrepreneurs, activists and citizens, giving them a voice in developing research that is
238 compatible with their needs and aspirations. Citizen and participatory science have developed
239 as a model of scientific research conducted by non-professional scientists, but frequently carried
240 out in association with formal, scientific programmes or with professional scientists with the web
241 and social media as important agents of interaction. For the effective reuse of the outputs of
242 citizen and participatory science by other actors, including scientists, these products should be
243 subject to the curation, standardization and preservation methods necessary to ensure the
244 maximum benefit to all. While active involvement of citizens and communities has direct
245 dividends for science, the benefits are further multiplied by increasing the fraction of the
246 population knowledgeable about science and supportive of it.
247

248 (viii) **Openness to Diversity of Knowledge:** Open science recognizes the richness of diverse
249 knowledge systems and epistemologies and diversity of knowledge holders and producers. It

Commenté [MOU1]: As a molecular biologist, I would say this is written with a focus on digital materials but open "physical" materials, e.g. reagents, do not seem to be covered here. It might be useful to expand this point to include "Open materials" or "Open methodology".

Commenté [MOU2]: It is unclear to me why this (very important) part is under "Open Evaluation" and not III "Open software and hardware", perhaps an additional point on "Open methodology" might be needed? Open Notebooks are useful understand how to get from data to results but, as far as I understand, open evaluation is about the practice of peer review, not necessarily the publication of additional research outputs (like data or notebooks/ other materials).

250 aims to enhance inter-relationships and complementarities between diverse scholars and
251 epistemologies based on the principle of non-discrimination, adherence to international human
252 rights norms and standards, respect for knowledge sovereignty and governance, and the
253 recognition of rights of knowledge holders to receive a fair and equitable share of benefits that
254 may arise from the utilization of their knowledge. In particular, Open Science promotes:

- 255 • **Openness to Indigenous Knowledge Systems** in line with the 2007 United Nations
256 Declaration on the Rights of Indigenous Peoples and the principles for Indigenous Data
257 Governance, such as for example the CARE (Collective Benefit, Authority to Control,
258 Responsibility, and Ethics) data principles. Such efforts acknowledge the right of
259 Indigenous peoples and local communities to govern and make decisions on the
260 custodianship, ownership and administration of data on traditional knowledge and on
261 their lands, and resources.
- 262 • **Openness to all Scholarly Knowledge and Inquiry** in line with principles of non-
263 discrimination established by international human rights law, including income, gender,
264 age, race, ethnicity, migratory status, disability, and geographic location.

Commenté [MOU3]: Should sexuality be added to the list here?

267 10. Scientific outputs should be as open as possible, and only as closed as necessary. Open
268 Science affords necessary protection for sensitive data, information, sources, and subjects of study.
269 Proportionate access restrictions are justifiable on the basis of national security, confidentiality, privacy
270 and respect for subjects of study. This includes legal process and public order, trade secrets, intellectual
271 property rights, personal information and the protection of human subjects, of sacred indigenous
272 knowledge, and of rare, threatened or endangered species. Some research results, data or code that is
273 not opened may nonetheless be made accessible to specific users according to defined access criteria
274 made by local, national or regional pertinent governing instances. The need for restrictions may also
275 change over time, allowing the data to be made accessible at a later point. Open Science reflects the
276 need to respect protections and the right of communities and nations to preserve the use and
277 development of their knowledge and traditions, and to do so proportionately.

Commenté [MOU4]: Add "research materials" to account for non-digital materials?

Commenté [MOU5]: Or materials

278 11. The key objectives of adhering to Open Science are:

- 279 (i) maintaining and promoting good practice and scientific rigour, as well as accelerated
280 discovery by maximizing access to robustly described data, software, including source
281 code and methods underpinning scientific conclusions;
- 282 (ii) maximizing access to scientific knowledge and the reuse and combination of data and
283 software, including source code, and thereby maximizing the common good achieved
284 through public investment in scientific resources and infrastructures; and
- 285 (iii) maximizing the engagement and participation of all people and cultures in the scientific
286 process, thus fostering the democratization of the scientific process and the increased
287 societal impact of the scientific endeavor for the greater common good.

Commenté [MOU6]: And materials

Commenté [MOU7]: And materials

288 12. There are multiple actors in research and innovation systems and each of them has a role to
289 play for Open Science, and responsibilities associated with that role and some or all of the
290 aforementioned objectives. The present Recommendation specifically addresses the following key Open
291 Science actors:

- 292 (i) **Researchers**, regardless of their nationality, ethnicity, gender, discipline and socio-
293 economic background, who are at the center of Open Science activities;
- 294 (ii) **Leaders** at research institutions who are key to developing a supportive structure and
295 reward system for Open Science practices;
- 296 (iii) **Educators**, including university faculty, experts in the ethical conduct of science, members
297 of professional societies, and innovators in the private sector, who all have a role to play in
298 the training related to open science principles and practices, and in educating all actors
299 about open collaboration at all levels;
- 300 (iv) **Information scientists**, including librarians and computer scientists, who play a role in
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- 309 developing tools for Open Science practices and for ensuring that the products of research
310 are appropriately stewarded and preserved for future use;
- 311
- 312 (v) **Software developers, coders, creatives, innovators, engineers** and all people that
313 engage in peer production of science contributing to the dynamic hybrid interdisciplinary
314 spaces where open science is practiced and advanced.
- 315
- 316 (vi) **Legal scholars, legislators, magistrates and civil servants** who by their services enable
317 the smooth functioning of the legal frameworks benefitting Open Science practices;
- 318
- 319 (vii) **Publishers, editors and leaders of professional societies**, who ensure a transition
320 toward publication models that support Open Science;
- 321
- 322 (viii) **Technical staff** who ensure the appropriate functioning of the infrastructure, so that
323 production and dissemination of outputs can be in line with Open Science;
- 324
- 325 (ix) **Research funders** who provide the necessary resources for the broad range of Open
326 Science practices;
- 327
- 328 (x) **Policy makers, societal actors and communities** that provide the policy foundation and
329 political support for changes in the practice of science and for ensuring the public benefit;
- 330
- 331 (xi) **Users and the public at large** who appreciate available scientific outputs, provide relevant
332 feedback, communicate science and/or create value-added outcomes in collaboration with
333 or without the original producers of scientific outputs.
- 334

335 13. Open Science exists today with scientific outputs already available in the public domain or under
336 open license schemes, such as for example Creative Commons licenses, that allow re-distribution and
337 re-use of a licensed work under specific conditions, including that the creator is appropriately credited.

338

339 14. Open Science critiques and transforms the boundaries of intellectual property to increase
340 access to knowledge by everyone. The open approach does not contradict the use of intellectual
341 property as a route to benefit through private exploitation and use of knowledge to create competitive
342 new products or services and possibly bringing tangible economic benefits.

343

344 III. OPEN SCIENCE CORE VALUES AND GUIDING PRINCIPLES

345

346 15. The core values of Open Science stem from the ethical, epistemological and socio- technological
347 implications of opening science to society and broadening the principles of openness to the whole cycle
348 of scientific research. They include:

349

- 350 (i) **Collective Benefit:** as a global public good, Open Science belongs to humanity in common
351 and benefits humanity as a whole;
- 352
- 353 (ii) **Equity and Fairness:** Open Science should play a significant role in ensuring equity among
354 researchers from developed and developing countries, enabling fair and reciprocal sharing
355 of scientific inputs and outputs and equal access to scientific knowledge to both producers
356 and consumers of knowledge regardless of geography, gender, ethnicity or socio-economic
357 circumstances;
- 358
- 359 (iii) **Quality and Integrity:** Open Science should support high quality research by bringing
360 together multiple sources of knowledge and making research methods and outputs widely
361 available for rigorous review and scrutiny;
- 362
- 363 (iv) **Diversity:** Open Science should embrace a diversity of practices, workflows, languages,
364 research outputs and research topics that support the needs and epistemic pluralism of
365 diverse research communities, scholars, knowledge holders and social actors from different
366 countries and regions;
- 367
- 368 (v) **Inclusiveness:** In the common pursuit of new knowledge, Open Science should

Commenté [MOU8]: Leaders of professional societies appear to be targeted here as journal editors. However, they do not only and not necessarily play a part in publishing but they also shape other areas of research activities. I would include them also in II to say "leaders at research institutions or professional societies"

Commenté [MOU9]: Methods, materials and outputs?

369 meaningfully engage the scientific community as a whole, as well as the wider public and
370 knowledge holders beyond the institutionalized scientific community, including indigenous
371 peoples and other traditional communities, engages the scientific community as a whole,
372 as well as the wider public and knowledge holders.
373

Commenté [MOU10]: This is a repetition of the previous sentence, should probably be deleted?

374 16. The following guiding principles for Open Science provide a framework for enabling conditions
375 and practices within which the above values are upheld, and the ideals of Open Science are made a
376 reality:
377

- 378 (a) **Transparency, scrutiny, critique and verifiability:** increased openness in all stages of
379 the scientific endeavor enhances the societal impact of science and increases the capacity
380 of society as a whole to solve complex interconnected problems. Increased openness leads
381 to increased transparency and trust in scientific information and reinforces the fundamental
382 feature of science as a distinct form of knowledge based on evidence and tested against
383 reality, logic and the scrutiny of scientific peers. It is important to reaffirm, for a globally
384 interdependent world, with new technologies, the epistemological skepticism, which is the
385 foundation of Open Science and the source of its success.
386
- 387 (b) **Equal opportunities and access:** all researchers and societal actors regardless of country
388 of origin, gender, field of research, funding basis, or career stage have an equal opportunity
389 to contribute to and benefit from Open Science. Research outputs should be open by
390 default, with immediate and machine-readable access in open formats to content, metadata
391 and usage statistics, subject to constraints of safety, security and privacy.
392
- 393 (c) **Respect, responsibility and accountability:** with greater openness comes greater
394 responsibility for all Open Science actors, which, together with accountability and respect
395 forms the basis for good governance of Open Science.
396
- 397 (d) **Collaboration, participation and inclusion:** collaborations at all levels of scientific
398 process, beyond the boundaries of geography, language, generations, disciplines and
399 resources, should become the norm, together with the full and effective participation of
400 societal actors and inclusion of excluded and marginalized knowledge in solving problems
401 of social importance.
402
- 403 (e) **Flexibility:** due to the diversity of science systems, actors and capacities across the world,
404 as well as the evolving nature of supporting information and communication technologies,
405 there is no one-size fits all way of practicing Open Science. Different pathways of transition
406 to and practice of Open Science need to be encouraged while upholding the above
407 mentioned core values and maximizing adherence to the other principles hereby presented.
408
- 409 (f) **Sustainability:** to be as efficient and impactful as possible, Open Science needs to build
410 on sustainable practices, services, infrastructures and funding models that ensure the equal
411 participation of scientific producers from less privileged institutions and countries. Open
412 Science infrastructures should be non-profit, and they should guarantee permanent and
413 unrestricted access to all public.

414 IV. AREAS OF ACTION

415
416 17. To achieve the objectives of this Recommendation as set out in paragraph 6 above, Member
417 States are recommended to take concurrent action in the following seven areas, taking into account their
418 individual political, administrative and legal contexts.
419

420 (i) Promoting a common understanding of Open Science and diverse paths to Open Science

421
422 18. Member States are recommended to promote and support the common understanding of Open
423 Science as defined in this Recommendation, and strategically plan and support Open Science awareness
424 raising at institutional, national and regional levels. Member States are encouraged to consider the
425 following:
426

- 427 (a) Promoting a common understanding of Open Science as defined in this Recommendation
428 within the scientific community and among the different Open Science actors at the
429 institutional, national and regional levels;
430
- 431 (b) Ensuring that Open Science incorporates the values and principles as outlined in this
432 Recommendation to ensure that the benefits of Open Science are shared and reciprocal,
433 and do not involve extraction of data and knowledge by technologically and economically
434 more advanced countries;
435
- 436 (c) Encouraging Open Science practices within publicly funded research practices;
437
- 438 (d) Incorporating Open Science into national science technology and innovation policies and
439 strategies and other national and regional policy frameworks for the public advancement of
440 science;
441
- 442 (e) Ensuring that the needs and rights of communities, including the rights of indigenous
443 peoples over their traditional knowledge, as expressed in the 2007 United Nations
444 Declaration on the Rights of Indigenous Peoples should not be infringed in Open Science
445 practices;
446
- 447 (f) Engaging the private sector in the discussion about the ways in which the scope of Open
448 Science principles and priorities can be enlarged and mutually shared.
449

450 **(ii) Developing an enabling policy environment for Open Science**
451

452 19. Member States, according to their specific conditions, governing structures and constitutional
453 provisions, should develop or encourage policy environments, including those at the institutional and
454 national levels that are supportive of transition to Open Science and effective implementation of Open
455 Science practices. Through a transparent participatory process that includes dialogue with the scientific
456 community and other Open Science actors, Member States are encouraged to consider the following:
457

- 458 (a) Developing and implementing national Open Science policies and strategies in line with the
459 definition, values and principles as well as actions outlined in this Recommendation;
460
- 461 (b) Ensuring that public research funders require Open Science practices and that all scientific
462 outputs from publicly funded research are as open as possible, and only as closed as necessary;
463
- 464 (c) Encouraging research-performing institutions, particularly those in receipt of public funds, to
465 implement policies and strategies for Open Science.
466
- 467 (d) Encourage academies, scientific unions and associations, and learned societies to adopt
468 statements of principle in line with this Recommendation to encourage Open Science practice in
469 coordination with national science academies and the International Science Council;
470
- 471 (e) Promoting multilingualism, to embrace worldwide inclusiveness, information- sharing,
472 collaborative knowledge construction and equity, by enabling global interaction with
473 multinational and multidisciplinary researchers, and other Open Science actors;
474
- 475 (f) Including citizen and participatory science as integral parts of Open Science policies and
476 practices at the national, institutional and funder levels;
477
- 478 (g) Designing models that allow co-production of knowledge with heterogeneous actors and
479 establishing guidelines to ensure the recognition of non-scientific collaborations;
480
- 481 (h) Supporting the development of national/international legal instruments to allow for sharing
482 across repositories without regard to national or regional boundaries;
483
- 484 (i) Fostering equitable public-private partnerships for Open Science and engaging the private sector
485 in Open Science, provided that there is appropriate certification and regulation to prevent vendor
486 lock-in, predatory behavior and extraction of profit from publicly funded activities. The importance

487 of commercial providers of services and data renders the call for open availability of information
488 and data as well as transparency about their quality and provenance even more urgent. Given
489 the public interest in Open Science and the role of public funding, Member States should ensure
490 that the market for services relating to science and Open Science functions properly in the global
491 and public interest and without market dominance on the part of any commercial organizations;
492

493 (j) Designing and implementing funding and investment policies and strategies for Open Science
494 based on the core values and principles of Open Science. The costs associated with the transition
495 to Open Science relate to the necessary cultural change in research settings to support Open
496 Science practices, the development and adoption of Open Science infrastructures and services;
497 capacity building of all actors and innovative, highly collaborative and participatory approaches
498 to the scientific enterprise. Where Open Science receives public funds, it is vital to consider how
499 such funds are disbursed most effectively for public benefit and maximum return on investment.
500

501 **(iii) Investing in Open Science infrastructures and services**
502

503 20. Open Science both requires and merits systematic and long-term strategic investment in
504 science technology and innovation, with emphasis on investment in technical and digital infrastructure
505 and related services. Considering Open Science as a global public good, Open Science services should
506 be viewed as essential research infrastructures, governed and owned by the community, and funded
507 collectively by governments, funders and institutions reflecting the diverse interests and needs of the
508 research community and society. Member States are encouraged to ensure adequate investment in:
509

510 (a) National science technology and innovation systems, with at least 1% of national gross domestic
511 product (GDP) dedicated to research and development expenditure.
512

513 (b) Reliable internet connectivity and bandwidth for use by scientists and science- users across the
514 world.
515

516 (c) National research and education networks (NRENs) and their functionality, encouraging
517 regional and international collaboration to ensure maximum interoperability and alignment
518 between NREN services.
519

520 (d) Computing facilities and digital public infrastructure supporting Open Science in order to ensure
521 the long-term preservation, stewardship, and community control of research products. Any
522 research supporting infrastructure or service should have a strong community-led base and
523 ensure interoperability and inclusivity. These open infrastructures could be supported by direct
524 funding or through an earmarked percentage of each funded grant.
525

526 (e) Federated and diversified information technology infrastructure for Open Science, including
527 high performance computing and data storage where needed, and robust, open and community
528 managed infrastructures, protocols and standards to support bibliodiversity and engagement
529 with society. While avoiding fragmentation by enhancing the federation of existing Open Science
530 infrastructures and services, attention should be given to ensuring that this infrastructure is
531 accessible for all, internationally interconnected and as interoperable as possible, and that it
532 follows certain core specifications, such as for example the FAIR and CARE principles for data
533 stewardship. Technical requirements for every digital object of significance for science, whether
534 a datum, a dataset, metadata, code, a publication should also be addressed. Examples include
535 attribution of persistent identifier for digital objects, metadata required for their efficient
536 assessment, access, use and re-use, and the stewardship of data by a trusted global network
537 of data repositories.
538

539 (f) Community agreements which define community practices for data sharing, data formats,
540 metadata standards, ontologies and terminologies, tools and infrastructure. International
541 Scientific Unions and Associations, regional or national research infrastructures, and journal
542 editorial boards each have a role to play in helping develop these agreements.
543

544 (g) Joint strategies for shared, multinational, regional Open Science platforms. Such initiatives are
545 a mechanism to provide coordinated support for Open Science covering: access to Open
546 Science services and research infrastructures (including storage, stewardship, data Commons),

Commenté [MOU11]: Again, what's missing is infrastructure for non-digital materials (e.g. reagents), maybe they could be added here

Commenté [MOU12]: Sharing of data and materials

547 alignment of policies, educational programmes and technical standards. With a number of
548 initiatives underway in different regions, it is important that they should interoperate from the
549 perspective of policy, practices and technical specifications. It will also be important to invest in
550 funding programmes to enable scientists to create and use such platforms, particularly in low-
551 and middle-income countries.

- 552
- 553 (h) A new generation of open information technology tools that automate the process of searching
554 and analyzing linked articles and data, making the process of generating and testing
555 hypotheses faster and more efficient. These tools and services will have maximum impact when
556 used within an Open Science framework that spans institutional, national, and disciplinary
557 boundaries, while addressing potential risks and ethical issues that may arise from the
558 development and use of such artificial intelligence technologies.
 - 559
 - 560 (i) Innovative approaches at different stages of the scientific process and the international scientific
561 collaboration as outlined, respectively, in paragraph 24 below of this Recommendation.
 - 562
 - 563 (j) Platforms for exchanges and co-creation of knowledge between scientists and society,
564 including through predictable and sustainable funding for volunteer organizations
565 conducting Citizen Science and participatory research at the local level.
 - 566
 - 567 (k) Community-based monitoring and information systems to complement national, regional
568 and global data and information systems.

569

570 **(iv) Investing in capacity building for Open Science**

571

572 21. Open Science requires investment in capacity building and human capital. Transforming
573 scientific practice to adapt to the changes, challenges, opportunities and risks of the 21st century digital
574 era, requires targeted research, education and training in the skills required for new technologies and in
575 the ethos and practices of Open Science. This should have as its objective to develop the critical mass
576 of scientists respecting gender, geographical and disciplinary balance with specific capacity building and
577 training in Open Science. Member States are encouraged to consider the following:

- 578
- 579 (a) Providing systematic and continuous capacity building on Open Science concepts, principles and
580 practice, including data science and stewardship, curation and archiving, information and data
581 literacy, web safety, content ownership and sharing, as well as software engineering and
582 computer science;
 - 583
 - 584 (b) Investing in and promoting advanced education and the professionalization of roles in data
585 science and data stewardship. To take advantage of the opportunities offered by Open Science,
586 research projects, research institutions and civil society initiatives need to call on advanced data
587 science skills including analysis, statistics, machine learning (ML) / artificial intelligence (AI),
588 visualization and the ability to write code and use algorithms with scientific and ethical
589 responsibility. Enabling Open Science also requires advanced and professional data stewards
590 who manage and curate data and ensure that the data are FAIR and looked after by trusted
591 institutions or services;
 - 592
 - 593 (c) Agreeing on a standardized set of Open Science competencies aligned with specific researcher
594 career stages and specific actors' needs and develop recognized skills and training
595 programmes in support of the attainment of these competencies. A core set of data science and
596 data stewardship skills should be regarded as part of the foundational expertise of all
597 researchers and incorporated into the 'research skills' curriculum starting at least at the
598 undergraduate level;
 - 599
 - 600 (d) Promoting the use of Open Educational Resources to increase access to Open Science
601 educational and research resources, improve learning outcomes, maximize the impact of public
602 funding, and empower educators and learners to become co-creators of knowledge.

603

604 **(v) Transforming scientific culture and aligning incentives for Open Science**

605

606 22. Member States, according to their specific conditions, governing structures and constitutional

Commenté [MOU13]: Again, this only takes into account digital materials, stewardship of non-digital materials is also important

Commenté [MOU14]: See comment above on stewardship of non-digital materials

Commenté [MOU15]: This is too narrowly focused on data, in particular digital data. Competencies also need to include the sharing of methods and materials in digital and non-digital form.

607 provisions, are recommended to actively engage in removing the barriers and disincentives for Open
608 Science, particularly those relating to research and career evaluation and awards systems. Assessment
609 of scientific contribution and career progression rewarding good Open Science practices is a prerequisite
610 for transition to Open Science. Attention should also be given to preventing and mitigating the
611 unintended negative consequences of the transition to Open Science, such as increased costs for
612 scientists, migration, exploitation and privatization of data from the global South by the global North, loss
613 of intellectual propriety and knowledge, and premature sharing of research results. Member States are
614 encouraged to consider the following:

- 615
616
617 (a) Combining efforts of many different actors, including research funders, universities, journals, and
618 scientific societies across disciplines and countries, to change the current research culture and
619 to reward researchers for sharing, collaborating and engaging with society;
620
621 (b) Reviewing research assessment and career evaluation systems in order to align them with the
622 principles of Open Science. Considering that a commitment to Open Science requires time and
623 attention that cannot be automatically converted into traditional academic output such as
624 publications, but which can have a significant impact on science and society, evaluation
625 systems should take into account the wide breadth of missions within the knowledge chain:
626 basic research, curiosity- driven research, research that furthers technological innovation, and
627 research that contributes to understanding and solving social problems. These missions come
628 with different forms of knowledge creation and communication, not limited to publishing in peer
629 reviewed international journals;
630
631 (c) Promoting the development and implementation of evaluation systems that:
632
633 • use indicators more wide-ranging than journal-based metrics and that go beyond the Journal
634 Impact Factor;
635
636 • give value to all relevant research activities and scientific outputs including high quality FAIR
637 data and metadata; well-documented and reusable software, protocols and workflows; and
638 machine-readable summaries of findings;
639
640 • take into account evidence of research impact and knowledge exchange, such as widening
641 participation in the research process, influence on policy and practice and engaging in open
642 innovation with partners beyond academia.
643
644 (d) Ensuring that the practice of Open Science is a known, well-understood and standardized
645 element in academic recruitment and promotion criteria;
646
647 (e) Ensuring diversity in scholarly communications with adherence to the principles of open,
648 transparent and equitable access and supporting collaborative publishing models with no article
649 processing charges (APCs) or book processing charges (BPCs), as many low- and middle-
650 income countries would find it difficult to fund APCs or BPCs so that, though their researchers
651 would be able to read freely, they would be largely unable to publish;
652
653 (f) Enforcing effective governance measures and proper legislation (such as for example those
654 proposed via the CARE principles on indigenous data governance and the 2010 Nagoya
655 Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising
656 from their Utilization to the Convention on Biological Diversity) in order to address inequality
657 and prevent related predatory behaviours as well as to protect the intellectual creation of Open
658 Science methods, products and data;
659
660 (g) Promoting creative commons licensing schemes that allow re-distribution and re- use of a
661 licensed work on the condition that the creator is appropriately credited;
662
663 (h) Promoting high quality and responsible research in line with the 2017 UNESCO
664 Recommendation on Science and Scientific Researchers and exploring the potential of Open
665 Science practices to reduce scientific misconduct, including the fabrication and falsification of
666 results and plagiarism.

Commenté [MOU16]: "Universities" might be too narrow, "Research performing institutions" might be better? What is also missing here is "Individual researchers" because there are many of us working towards culture change. I'm not sure in how far "policy makers" should be explicitly mentioned here as well?

Commenté [MOU17]: "Publishers" instead of "journals"?

Commenté [MOU18]: Possibly include non-digital materials here as well

667
668 **(vi) Promoting innovative approaches for Open Science at different stages of the scientific**
669 **process**
670

671 23. Open Science requires changes in scientific culture, methodologies, institutions and
672 infrastructures, and its principles and practices extend to the entire research cycle, from formulation of
673 hypothesis, development and testing of methodologies, data collection, analysis, management and
674 storage, peer-review and other evaluation and verification methods, to communication, distribution and
675 uptake and use/re-use. To promote innovative approaches for openness at different stages of the
676 scientific process, Member States are encouraged to:

- 677
678 (a) Promote Open Science from the outset of the research process and extending the principles of
679 openness in all stages of the scientific process including the encouragement of preprints in order
680 to accelerate dissemination and encourage rapid growth in scientific knowledge;
681
682 (b) Develop new participatory methods and validation techniques to incorporate and value inputs
683 from the broader public, including through participatory and citizen science;
684
685 (c) Support scientists and other societal actors in accumulating and using open data resources in
686 a transdisciplinary mode to maximize scientific, social and economic benefit, and stimulate the
687 creation of hybrid disciplinary spaces where scientists from different disciplines interact with
688 software developers, coders, creatives, innovators, engineers, etc;
689
690 (d) Enhance open access to large-scale research infrastructures, such as international infrastructure
691 in physics, astronomy, and space science, as well as collaborative infrastructures in other fields,
692 such as health and social sciences, among others;
693
694 (e) Promote Open Science as an enabler of open innovation, with the objective of accelerating the
695 transformation of scientific and research results for social economic and environmental benefits,
696 and of providing spaces for engagement of a whole spectrum of actors in the research value
697 chain, from individual researchers to research institutions, public and private organizations and
698 small and medium scale enterprises, start-up firms and consolidated large commercial
699 enterprises.
700

701 **(vii) Promoting international cooperation on Open Science**
702

703 24. To promote Open Science globally, Member States should promote and reinforce international
704 cooperation among all relevant actors, whether on a bilateral or multilateral basis. Member States are
705 encouraged to consider the following:
706

- 707 (a) Promoting and stimulating cross-border collaboration on Open Science, leveraging existing
708 transnational, regional and global collaboration mechanisms and organizations. This
709 should include joining efforts towards universal access to the outputs of science, regardless
710 of discipline, geography, gender, ethnicity or socio- economic circumstances; development
711 and use of shared Open Science infrastructures, as well as capacity building, repositories,
712 communities of practice, and solidarity between all countries regardless of their state of
713 Open Science development;
714
715 (b) Establishing regional and international funding mechanisms for promoting and
716 strengthening Open Science and identifying those mechanisms, including partnerships,
717 which can support international, regional and national efforts;

Commenté [MOU19]: Have researchers from the humanities commented on this? The use of preprints is very underdeveloped and might not even be useful?

Commenté [MOU20]: Delete "data" to make it more inclusive, "open resources" would be perfect

- (c) Supporting the creation and maintenance of effective collaborative networks to exchange best Open Science practices and lessons learned from the design, development and implementation of Open Science policies, initiatives and practices;
- (d) Promoting cooperation among countries in capacity building for data management and stewardship and to prevent the exploitation and misuse of open data across borders;
- (e) Entrusting UNESCO with the mission to coordinate, in consultation with stakeholders and member states, the development and adoption of a set of Open Science Goals, which will guide and stimulate international cooperation to advance Open Science for the benefit of humankind and planetary sustainability.

Commenté [MOU21]: Again, it's not just data but also non-digital materials that need to be managed

V. MONITORING

25. Member States should, according to their specific conditions, governing structures and constitutional provisions, monitor policies and mechanisms related to Open Science using a combination of quantitative and qualitative approaches, as appropriate. Member States are encouraged to consider the following:

- (a) deploying appropriate research mechanisms to measure the effectiveness and efficiency of Open Science policies and incentives against defined objectives;
- (b) collecting and disseminating progress, good practices, innovations and research reports on Open Science and its implications with the support of UNESCO with a multi-stakeholder approach;
- (c) developing strategies to monitor the effectiveness and long-term efficiency of Open Science, which include a multi-stakeholder approach. Such strategies could focus on strengthening the connections between science, policy and society, increased transparency, and accountability for inclusive and equitable quality research, which effectively responds to global challenges.