ROSiE

D1.1: Report on the relationship (tensions, challenges, overlaps) between RI, the wider RE perspective and OS

Authors: Ana Sofia Carvalho & Maria Strecht Almeida

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Consortium:

	ROLE	NAME	Short Name	Country
1.	Coordinator	University of Oslo	UiO	Norway
2.	Partner	Austrian Agency for Research Integrity	OeAWI	Austria
3.	Partner	European Citizen Science Association	ECSA	Germany
4.	Partner	European Network of Research Ethics Committees	EUREC	Germany
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9.	Partner	University of Porto	UP	Portugal
10.	Partner	Latvijas Universitate	UL	Latvia
11.	Partner	Tartu Ulikool	UT	Estonia
12.	Partner	Universitetet I Sorost Norge	USN	Norway

ABSTRACT:	The present report provides an analysis on how the different official Codes of conduct on research integrity across Europe approach open science objectives. For the analysis on how the official RI Codes in different European countries approach OS objectives, all the available RI Codes of conduct from the different European countries (EU+) were considered. After defining the corpus of the study, we followed a qualitative methodology based on content analysis and a published procedure. This analysis allows us to map OS principles in the different Responsible Research National Codes and identifying whether RI/RE and OS principles match and to what extent in the different Codes. From the Codes analysed, responsibility in research is spread across so many areas (research ethics, research integrity, open science, responsible research and innovation, science communication) that it is difficult to define what a responsible investigator is. Also, as far as we were able to assess with our results, these areas are usually treated independently; for the corpus of analysis in pretest 1 and 2 only in the Austrian and the French Codes do these issues have been treated within the same document.
Keyword List	Research Integrity; European Code of Conduct for Research Integrity; National Codes of Conduct for Research Integrity; Open Science; Responsible Research; Open Access; Open Data; Reproducible Science; Open Collaboration; Citizen Science; Science Communication; Open Education

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1 Introductory note

Researchers should practice research responsibly. Unfortunately, some do not. For the past years, following public reports of major cases of irresponsible conduct, policy makers and the research community have been debating how to label, study, and respond to research behaviours that fall short of responsible conduct[1]. Similarly, concerns about reproducibility triggered debates about the extent to which research is in an alleged crisis[2].

More recently, the research ecosystem, mainly in Europe (e.g. universities, research institutions, funding agencies), are increasingly committing themselves to 'open science' norms[3]. Those norms are progressively seen, at least from these stakeholders, as the basis of good academic practice and a "magic password" for making science reliable and reproducible and increasing trust in scientific endeavour. We have been there with research integrity and, unfortunately, the results don't seem as magical as we could anticipate.

We may define research integrity[4] as "research behaviour viewed from the perspective of professional standards" and is different from research ethics, which is "research behaviour viewed from the perspective of moral principles." That is, research integrity is defined through the valuation of a set of values/principles, established as duties or norms. The European Code of Conduct for Research Integrity (ECoC)[5], that defines action-oriented norms, based on these 4 values:

> **Reliability** in ensuring the quality of research, reflected in the design, the methodology, the analysis and the use of resources;
>
> **Honesty** in developing, undertaking, reviewing, reporting and communicating research in a transparent, fair, full and unbiased way;
>
> **Respect** for colleagues, research participants, society, ecosystems, cultural heritage and the environment;

[1] Steneck, N. H. (2006). Fostering integrity in research: Definitions, current knowledge, and future directions. *Science and engineering ethics*, *12*(1), 53-74.

[2] Haven, T., Gopalakrishna, G., Tijdink, J., van der Schot, D., & Bouter, L. (2022). Promoting trust in research and researchers: How open science and research integrity are intertwined. BMC Research Notes, 15(1), 302.

[3] Vicente-Saez, R., & Martinez-Fuentes, C. (2018). Open Science now: A systematic literature review for an integrated definition. *Journal of business research*, *88*, 428-436.

[4] Komić, D., Marušić, S. L., & Marušić, A. (2015). Research integrity and research ethics in professional codes of ethics: Survey of terminology used by professional organizations across research disciplines. *PloS one*, *10*(7), e0133662.

[5] All European Academies. (2017). The European Code of Conduct for Research Integrity. https://www.allea.org/wp-content/uploads/2017/05/ALLEA-European-Code-of-Conduct-for-Research-Integrity-2017.pdf

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> **Accountability** for the research from idea to publication, for its management and organisation, for training, supervision and mentoring, and for its wider impacts.

Within the norms in open science, we may find: open access, open data, open methods and tools, open evaluation, citizen science and open collaboration and science communication. Mainly these norms could be framed within two main areas; **conduct of research** (open data, open methods and tools, open evaluation, citizen science and open collaboration) and **dissemination of research** (open access and science communication). These norms are expressions of the principles and values of open science; transparency, openness, traceability. These values or principles are essential to achieve reproducibility and reliability and, in addition, increase science integrity.

Therefore, it is essential to analyse the cross-cutting issues within the two areas in order to try conceptualise both within an integrated perspective. How the official RI Codes in different European countries approach OS ideas is the main question of the present study. Additionally, the study examines tensions, challenges and overlaps between RI, the wider RE perspective and OS. The publication of ECoC (in 2017)[6] and the implementation of OS policies in Europe (after 2019)[7] make the present study timely.

Present report aims to update the results previously presented for the Task 1.2 “Open Science, RI and RE”.

[6] All European Academies. (2017). The European Code of Conduct for Research Integrity. https://www.allea.org/wp-content/uploads/2017/05/ALLEA-European-Code-of-Conduct-for-Research-Integrity-2017.pdf

[7] https://ec.europa.eu/info/sites/default/files/research_and_innovation/knowledge_publications_tools_and_data/documents/ec_rtd_factsheet-open-science_2019.pdf

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2 Methods

For the analysis on how the official RI Codes in different European countries approach OS objectives, all the available RI Codes of conduct from the different European countries (EU+) were considered. As the selected Codes might not be purely RI but include also research ethics (RE), we will refer to them as Responsible Research National Codes.

After defining the corpus of the study, we followed a qualitative methodology based on content analysis and a previously published procedure (Laine, 2018)[8]. Briefly, documents were coded by using a categorization matrix regarding diverse domains: *publication*; *research data*; *research methods*; *evaluation*; *collaboration and communication*, exploring main categories of OS, specifically *open access*, *open data*, *reproducible science*, *open evaluation*, *citizen science and open collaboration*, and *science communication*. This analysis allows us to map OS principles in the different Responsible Research National Codes, identifying whether RI and OS principles match and to what extent in the different Codes. In the course of the research, an initial pilot study was conducted on four of the documents, which disclosed the importance of considering the diversity of definitions on open science and led to a new categorization matrix adapted to the ROSiE specific context. When broadening the analysis to the 19 Responsible Research National Codes that constitute the corpus of the study, some refinements were conducted. Even if it is clear that research ethics is not the same thing as research integrity, at policy level the fields often overlap; therefore, our point of departure has been the National Codes of Responsible Science that addressed Research Integrity and/or Research Ethics. The pilot study was more inclusive and this mean that in the final analysis, some differences arose for the documents included in the pretest.

The study reported here involved a series of steps:

- MAPPING the EU28+ Responsible Research National Codes
- PRETESTING (1) the methodology and categorization matrix
- REVIEWING responsible research and open science definitions
- PRETESTING (2) the new categorization matrix after reviewing definitions
- FINAL CONTENT ANALYSIS of the full set of National Codes of Responsible Research.

[8] Laine, H. (2018) Open science and codes of conduct on research integrity. *Informaatiotutkimus*, 4(37), 48-74. https://doi.org/10.23978/inf.77414

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2.1 MAPPING the EU28+ Responsible Research National Codes

Search

Over the last few years, several National Codes on Responsible Research have been drafted by the different EU member States + Associated Countries (to Horizon Europe Programme[9]). Our aim has been to update the situation presented before by Godecharrle et al. (2013)[10] of the EU27+ countries Codes of RI through searching the platforms of the Embassy of Good Science[11] and the European Network of Research Integrity Offices (ENRIO)[12]. An additional search of the documents on research integrity from all EU27 countries of the European Union plus the Participating Countries in Horizon Europe (countries with association agreements (10), countries that are running association negotiations (8) and Switzerland (that is not covered by transitional agreements on the Horizon Europe but has been an associated country in H2020 programme) has been conducted. For that purpose, Google, Google Scholar and PubMed have been used. The following search terms and their relevant combinations: "biomedical research", "scientific misconduct", "research misconduct", "research ethics", "scientific integrity", "mentoring", "education", "biomedical research", "mentor", "training", "bioethics", "models of prevention", "prevention of research misconduct", "prevention", "good scientific conduct",

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[9] **List of Participating Countries in Horizon Europe** (https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/common/guidance/list-3rd-country-participation_horizon-euratom_en.pdf)
"Third countries associated with Horizon Europe Association to Horizon Europe is governed by the Horizon Europe Regulation 2021/695. Legal entities from Associated Countries can participate under equivalent conditions as legal entities from the EU Member States, unless specific limitations or conditions are laid down in the work programme and/or call/topic text."
"The association agreements with the following countries have now started to produce legal effects (either through provisional application or their entry into force) (listed in alphabetical order):
1. Bosnia and Herzegovina; 2. Georgia; 3. Iceland; 4. Israel; 5. Moldova; 6. Montenegro; 7. North Macedonia; 8. Norway; 9. Serbia; 10.Turkey"
"Until association agreements start producing legal effects either through provisional application or their entry into force, the transitional arrangement set out in the General Annexes to the Horizon Europe Work Programme 2021-2022 is applicable (for the entire Programme, including ERC, EIC, EIT and the institutionalised European partnerships4) with regard to the following countries and legal entities established in these countries, with which association negotiations are being processed or where association is imminent (listed in the alphabetical order):
1. Albania; 2. Armenia; 3. Faroe Islands; 4. Kosovo; 5. Morocco; 6. Tunisia; 7. Ukraine; 8. United Kingdom
(The UK will participate in all parts of the Horizon Europe programme with the only exception of the EIC Fund (which is part of the EIC Accelerator of Horizon Europe that provides investment through equity or other repayable form))"
"Legal entities established in Switzerland are currently not covered by the transitional arrangement."

[10] Godecharle, S., Nemery, B. & Dierickx, K. (2013) Guidance on research integrity: no union in Europe. *The Lancet*, 381 (9872), 1097-1098. https://doi.org/10.1016/S0140-6736(13)60759-X

[11] https://embassy.science/wiki/Main_Page

[12] http://www.enrio.eu/

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"responsible conduct of research", "disclosure", "self-disclosure", "guidelines", "scientific fraud", "fraudulent data", "misconduct in science", "questionable research", "questionable research practice", "fabrication", "falsification", "plagiarism", "Europe". The results obtained were double checked by 2 independent reviewers (Ana Sofia Carvalho and Maria Strecht Almeida) and further validated with the work published by Desmond & Dierickx (2021)[13]. Some of the Codes of conduct identified by these authors have been updated in the meantime and, therefore the updated version has been used in our analysis.

Selection

A total of 151 documents were initially obtained. From the first analysis 27 documents were discarded for being out of scope of RI/RE. The 124 that have been selected were organised within 6 different categories: NATIONAL CODES EU27+ (20+3, 23); RECOMMENDATIONS OR UNIVERSITY CODES (5+7, 12); INTERNATIONAL CODES (6); EU+ GUIDELINES/POLICY PAPERS (52); INTERNATIONAL GUIDELINES/POLICY PAPERS (6); PROFESSIONAL CODES OF CONDUCT (25).

For EU Member States, 20 countries (out of a total of 27), were found to have a leading regulatory document on RI. Among those currently without such a regulatory document, two (Bulgaria, Luxemburg) explicitly adopt the European Code of Conduct. A further three (Portugal, Greece and Slovenia) have stated the intention to develop a national-level framework. For Malta no national-level framework could be found.

For the associated countries within Horizon Europe, National leading regulatory documents on RI have been found only for Norway. University specific documents have been found for Israel, Iceland and no references have been found for Bosnia and Herzegovina; Moldova; Montenegro; North Macedonia; Serbia; Turkey; and Georgia.

For the countries that are in the negotiation process to become associated countries to Horizon Europe, only the UK has leading regulatory documents on RI; no references have been found for the other countries (Albania; Armenia; Faroe Islands; Kosovo; Morocco; Tunisia; and Ukraine).

[13] Desmond, H. & Dierickx, K. (2021) Research integrity codes of conduct in Europe: Understanding the divergences. *Bioethics*, 35(5), 414-428. https://doi.org/10.1111/bioe.12851

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Legal entities established in Switzerland are currently not covered by the transitional arrangement of Horizon Europe; however Switzerland has been included due to their status as an associated country in the H2020 framework programme.

From the 23 national Codes selected, four were excluded – the Codes from Croatia, Lithuania, Romania and Slovakia – as an official English version language could not be found.

Figure 1 shows the document selection process flowchart. The final corpus includes 19 official documents.

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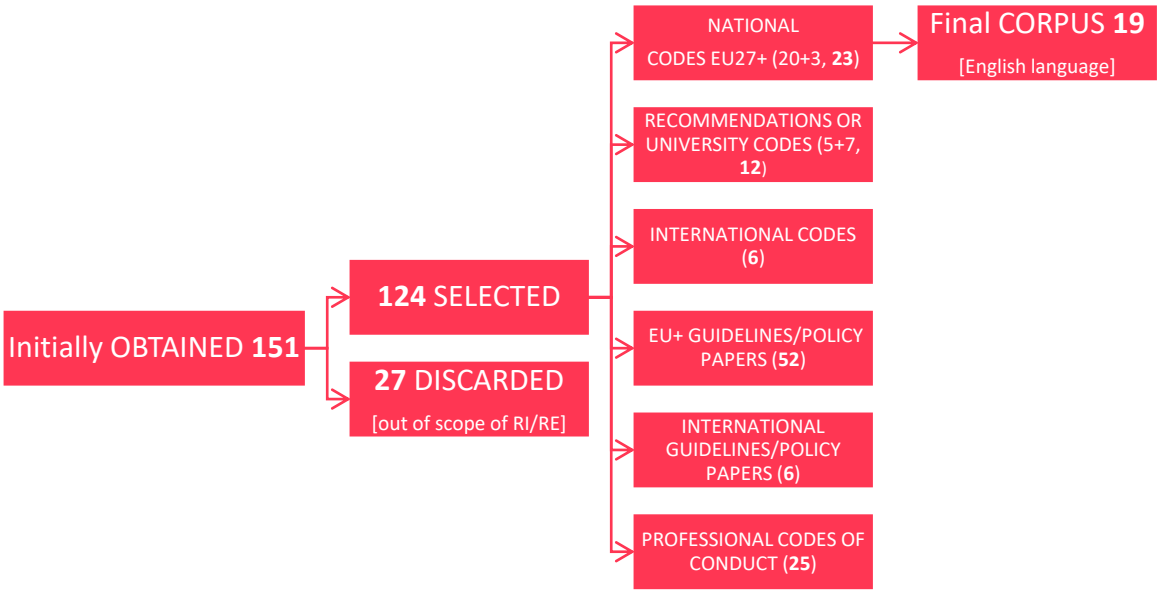

Figure 1. Flowchart of the selection of national responsible research Codes of conduct for inclusion in the final corpus of the study.

2.2 PRETESTING (1) the methodology and categorization matrix

A pre-analysis on how the Codes regarding RI approach OS was conducted in four of the 19 National Codes of Research Integrity of the corpus. The selection has been performed in order to include Codes that have been published before ECoC (2017) – Belgium (2009), Denmark (2015) –, after ECoC – France (2019) – and after ECoC and EU Open Science Policy (2019) – Austria (2020).

For this purpose and as mentioned before, in **pretest 1** we performed a content analysis following the procedure described by Laine (2018)[14], looking at each of the categories and sub-categories of OS identified in that work and determining if they are included in the different Codes of conduct of this study. Laine's categories and sub-categories are as follows (categories followed by sub-categories between brackets): *open access* (*access to research publications*; *reuse of research publications*); *open data* (*access to and reuse of research data metadata*; *access to and reuse of research data*; *importance of research data as a research output*; *transparency of research data as evidence*);

[14] Laine, H. (2018) Open science and codes of conduct on research integrity. *Informaatiotutkimus*, 4(37), 48-74. https://doi.org/10.23978/inf.77414

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reproducible science (*transparency and reproducibility of research methods; transparency and reproducibility of research tools*); *open evaluation* (*transparency of research evaluations; content-based evaluation; transparent peer review*); *citizen science and open collaboration (access to research processes*; *access to research infrastructure and tools*; *shared and reciprocated benefits of research*); and *science communication* (*scientific knowledge in universally understandable format*; *proactive and targeted societal outreach*). The coding was conducted independently by the two researchers for further analysis.

2.3 REVIEWING responsible research and open science definitions

Following the results of the pretest 1 and discussions within the consortium and in WP1 meetings, we realised that more precise definitions of the terms "responsible conduct of research," "research ethics," "research integrity," and "open science" should be drafted. To map the definitions to be used along the further steps, we performed a review of the publicly available reports from relevant EU funded research projects[15] and the scientific literature provided by these reports.

2.4 PRETESTING (2) the new categorization matrix with the definitions of 2.3

After setting out the diverse definitions and in accordance with the consortium and WP1 meetings, the categorisation matrix has been filled up again. The same four Codes of conduct of pretest 1 have been analysed: two National Codes published before ECoC (2017) – Belgium (2009), Denmark (2015) –, one Code published after ECoC – France (2019) – and another Code published after ECoC and EU Open Science Policy (2019) – Austria (2020). After individual analysis by the two researchers (including coding within NVivo) the results have been compared. In this cross-checking of results, it seemed adequate to merge some of the initial sub-categories: "a*ccess to and reuse of research data metadata*" was merged with "*access to and reuse of research data"*; "*importance of research data as a research output"* was merged with "*transparency of research data as evidence"*; "*transparency of research evaluations"* was merged with "*transparent peer review"*. Additionally, a new domain was included – *education* – and the OS category – *open education*. In the end, **pretest 2** covers an extra domain and merges some of the sub-categories of OS used in pretest 1, in accordance with the

[15] *E.g.*, FOSTER (https://www.fosteropenscience.eu/) and ENERI (https://eneri.eu/)

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diversity of the definitions and ROSiE objectives. The final list of categories and subcategories used is detailed together with results from the pretest 2 (mentioned below in Table 7).

2.5 FINAL CONTENT ANALYSIS of the full set of Responsible Research National Codes

The results of pretest 2 were deemed final for the Codes of conduct examined. The (consensus) categorization has been conducted within NVivo. The coding of the four documents included in pretests provides the basis to the auto-coding of the remaining documents in NVivo. The results of the auto-coding process (using existing patterns), were reviewed by the two researchers for the completion of the analysis. As already mentioned, when analysing the full set of documents, some refinements on the categorization were conducted. For instance, a more precise discrimination between subcategories of Open Data by introducing the criteria of the “existence an incentive structure.” was done. This resulted in differences in the results for codes included in the pilot study.

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3 Results

3.1 MAPPING the EU28+ Responsible Research National Codes

The complete listing of the 19 National Codes of Conduct which make the corpus of the study is included in the appendix 1.

3.2 PRETESTING (1) the methodology and categorization matrix

The following tables (Tables 1-4) summarize the results of content analysis in pretest 1 using the marks adopted by Laine (2018): V if the sub-category clearly applies; (V) if the sub-category somehow applies. An additional mark was considered in this pretest, ~~V~~, meaning something found that may be divergent with OS principles. Most recent Codes are presented first. Only one set of results is shown.

The selected excerpts supporting the marks are presented in appendix 2.

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Table 1. Austrian Code [DOC 1], 2020.

Categorisation matrix category	Open science principle main category	Open science principle sub-category	DOC 1
Publication	Open Access	Access to research publications	V s13, s16
		Reuse of research publications	
Research Data	Open Data	Access to and reuse of research data metadata	(V) s5, s11, s12 V s17, s18
		Access to and reuse of research data	(V) s6, s10, s12, s14 V s17, s18
		Importance of research data as a research output	(V) s1, s3, s4, s7, s8, s9
		Transparency of research data as evidence	(V) s1, s4 ~~V~~ s26
Research Methods	Reproducible Science	Transparency and reproducibility of research methods	(V) s15
		Transparency and reproducibility of research tools	(V) s15
Evaluation	Open Evaluation	Transparency of research evaluations	(V) s2 V s19
		Content-based evaluation	V s20
		Transparent peer review	(V) s2 V s13, s16
Collaboration	Citizen Science & Open Collaboration	Access to research processes	V s15
		Access to research infrastructure and tools	
		Shared and reciprocated benefits of research	V s21, s22, s25
Communication	Science Communication	Scientific knowledge in universally understandable format	(V) s6 V s23, s24
		Proactive and targeted societal outreach	V s22

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Table 2. French Code [DOC 7], 2017.

Categorisation matrix category	Open science principle main category	Open science principle sub-category	DOC 7
Publication	Open Access	Access to research publications	V s5, s10, s11, s14, s15, s16, s21
		Reuse of research publications	(V) s16, s18, s19-20
Research Data	Open Data	Access to and reuse of research data metadata	V s1, s3, s5, s6, s7, s8, s9, s13
		Access to and reuse of research data	V s1, s3, s5, s6, s7, s8, s9, s13
		Importance of research data as a research output	V s8
		Transparency of research data as evidence	V s2; s4, s13
Research Methods	Reproducible Science	Transparency and reproducibility of research methods	V s7, s12
		Transparency and reproducibility of research tools	V s7, s12
Evaluation	Open Evaluation	Transparency of research evaluations	V s22, s25
		Content-based evaluation	V s23, s24, s26-28
		Transparent peer review	V s22, s25
Collaboration	Citizen Science & Open Collaboration	Access to research processes	V s7, s12
		Access to research infrastructure and tools	V s7
		Shared and reciprocated benefits of research	V s7, s29-30
Communication	Science Communication	Scientific knowledge in universally understandable format	V s17
		Proactive and targeted societal outreach	V s17, s29-30

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Table 3. Danish Code [DOC 4], 2014.

Categorisation matrix category	Open science principle main category	Open science principle sub-category	DOC 4
Publication	Open Access	Access to research publications Reuse of research publications	
Research Data	Open Data	Access to and reuse of research data metadata Access to and reuse of research data Importance of research data as a research output Transparency of research data as evidence	 (V) s6, s7, s8 (V) s3, s5 (~~V~~) s4 (V) s3, s11
Research Methods	Reproducible Science	Transparency and reproducibility of research methods Transparency and reproducibility of research tools	(V) s11 (V) s2, s11
Evaluation	Open Evaluation	Transparency of research evaluations Content-based evaluation Transparent peer review	(V) s10
Collaboration	Citizen Science & Open Collaboration	Access to research processes Access to research infrastructure and tools Shared and reciprocated benefits of research	(V) s2
Communication	Science Communication	Scientific knowledge in universally understandable format Proactive and targeted societal outreach	(V) s9 (V) s13

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Table 4. Belgian Code [DOC 2], 2009.

Categorisation matrix category	Open science principle main category	Open science principle sub-category	DOC 2
Publication	Open Access	Access to research publications	
		Reuse of research publications	
Research Data	Open Data	Access to and reuse of research data metadata	
		Access to and reuse of research data	(V) [s7]
		Importance of research data as a research output	(V) [s5]
		Transparency of research data as evidence	(V) [s1, s3]
Research Methods	Reproducible Science	Transparency and reproducibility of research methods	(V) [s6]
		Transparency and reproducibility of research tools	(V) [s6]
Evaluation	Open Evaluation	Transparency of research evaluations	
		Content-based evaluation	(V) [s8]
		Transparent peer review	
Collaboration	Citizen Science & Open Collaboration	Access to research processes	
		Access to research infrastructure and tools	
		Shared and reciprocated benefits of research	(V) [s2]
Communication	Science Communication	Scientific knowledge in universally understandable format	(V) [s4]
		Proactive and targeted societal outreach	(V) [s2]

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3.3 REVIEWING responsible research and open science definitions

As mentioned in the Methods section, pretest 1 led to the acknowledgment of the importance of reviewing the diversity of definitions at stake before proceeding with the analysis. This section lists excerpts from several sources and is structured in two main parts. The first on definitions of responsible conduct of research (RCR), RI, and RE; the second on definitions related to open science. The sources are presented in footnote with hyperlink.

As mentioned in Methods section, pretest 1 led to the acknowledgment of the importance of reviewing the diversity of definitions at stake before proceeding with the analysis. In fact, even in research integrity and research ethics, given the topic's long history it is rather ironic that one thing missing from the substantial discourse around integrity is clarity regarding terminology[16] It is our opinion that this ambiguity could have detrimental, effect on the analysis that we aim to perform. Therefore, in this section lists excerpts from several sources and is structured in two main parts. The first on definitions of responsible conduct of research (RCR), RI, and RE; the second on definitions related to open science. The sources are presented in footnote with hyperlink.

[16] Shaw D. The Quest for Clarity in Research Integrity: A Conceptual Schema. Sci Eng Ethics. 2019 Aug;25(4):1085-1093. doi: 10.1007/s11948-018-0052-2. Epub 2018 Mar 28. PMID: 29594670.

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3.3.1 On the definitions of responsible conduct of research, research integrity, and research ethics

Table 5 shows the definitions collected for the three concepts.

Table 5. Definitions of RCR, RI, and RE.

Concept	Definitions					
Responsible Conduct of Research	Undertaking research in accordance with code of research conduct.[17]	Conducting research in ways that fulfill the professional responsibilities of researchers, as defined by their professional organizations, institutions for which they work and, when relevant, the government and public.[18]	Following ethical and scientific standards and legal and institutional rules in the conduct of research[19]	Focuses on the way the research is carried out[20]		

[continues next page]

[17] https://www.academicintegrity.eu/wp/glossary/

[18] https://link.springer.com/content/pdf/10.1007/PL00022268.pdf

[19] https://www.niehs.nih.gov/research/resources/bioethics/glossary/index.cfm#research-ethic

[20] https://www.thphys.uni-heidelberg.de/~stamatescu/DIDEPG/SEMPE/SEE/see4_22234043.pdf

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Table 5 (continued)**.**

Concept	Definitions					
Research Integrity	Compliance with ethical and professional principles, standards and practices by individuals or institutions in research.[21]	Becomes the quality of possessing and steadfastly adhering to high moral principles and professional standards, as outlined by professional organizations, research institutions and, when relevant, the government and public.[22]	Research behavior measured in terms of and guided by professional standards.[23]	Is defined as possessing and steadfastly adhering to professional standards, as outlined by professional organizations, research institutions and, when relevant, the government and public[24]	[25] is recognised as the attitude and habit of the researchers to conduct their research according to appropriate ethical, legal and professional frameworks, obligations and standards. It describes an approach for conducting and organising good scientific work.	following ethical standards in the conduct of research[26]

[continues next page]

[21] https://www.academicintegrity.eu/wp/glossary/

[22] https://link.springer.com/content/pdf/10.1007/PL00022268.pdf

[23] https://link.springer.com/content/pdf/10.1007/PL00022268.pdf

[24] https://link.springer.com/content/pdf/10.1007/PL00022268.pdf

[25] https://eneri.eu/what-is-research-ethics/

[26] https://www.niehs.nih.gov/research/resources/bioethics/glossary/index.cfm#research-ethic

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Table 5 (continued)**.**

Concept	Definitions					
Research Ethics	Ethical principles-driven decision making in research based on potential impact on subjects of research and wider society.[27]	Research behavior measured in terms of and guided by moral principles.[28]	Can be defined as the critical study of the moral problems associated with or that arise in the course of pursuing research.[29]	Considers the application of research findings as well as the process of research.[30]	Addresses the application of ethical principles or values to various issues and fields of research, including[31]: ● ethical aspects of the design and conduct of research, ● the way human participants or animals within research projects are treated ● whether research results may be misused for criminal purposes, ● and aspects of scientific misconduct	1. Ethical conduct in research. 2. The study of the ethical conduct in research[32].

3.3.2 On definitions related to open science

[27] https://www.academicintegrity.eu/wp/glossary/

[28] https://link.springer.com/content/pdf/10.1007/PL00022268.pdf

[29] https://link.springer.com/content/pdf/10.1007/PL00022268.pdf

[30] https://www.thphys.uni-heidelberg.de/~stamatescu/DIDEPG/SEMPE/SEE/see4_22234043.pdf

[31] https://www.thphys.uni-heidelberg.de/~stamatescu/DIDEPG/SEMPE/SEE/see4_22234043.pdf

[32] https://www.niehs.nih.gov/research/resources/bioethics/glossary/index.cfm#research-ethic

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Table 6 the definitions related to OS within Laine's categorization matrix (followed in pretest 1).

Table 6. Summary of definitions related to open science and the categorization matrix.

Categorisation matrix category	Open science principle main category	Open science principle sub-category	NOTES
Publication	**Open Access** Open Access refers to online, free of cost access to peer reviewed scientific content with limited copyright and licensing restrictions[33]	**Access to research publications** **Reuse of research publications**	

[continues next page]

[33] https://www.fosteropenscience.eu/taxonomy/term/5

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Table 6 (continued)**.**

Categorisation matrix category	Open science principle main category	Open science principle sub-category	NOTES
Research Data	**Open Data** Open Data are online, free of cost, accessible data that can be used, reused and distributed provided that the data source is attributed and shared alike[34]	**Access to and reuse of research data metadata** **Access to and reuse of research data** Online and free of cost data supported with terms that allow reuse and redistribution.[35] Horizon Europe will require …responsible research data management so that data are Findable, Accessible, Interoperable and Re-usable (FAIR). Data will be made 'as open as possible, but will be allowed to stay as closed as necessary', safeguarding legitimate interests or constraints. However access to research outputs shall be provided for third parties to be able to verify or validate publications.[36] **Importance of research data as a research output** The sharing of all research outputs, including data, code, materials, and other types of information beyond the traditional research paper has the potential to aid the advancement of scientific progress generally and benefit individual researchers by adding transparency to their research process as well as potentially increasing citations to their work[37] However access to research outputs shall be provided for third parties to be able to verify or validate publications.[38] **Transparency of research data as evidence** …whereby researchers publicize the data they use as evidence[39]	FAIR PRINCIPLES[40] Findable Metadata and data should be easy to find for both humans and computers. Accessible Once the user finds the required data, she/he/they need to know how they can be accessed Interoperable The data usually need to be integrated with other data. In addition, the data need to interoperate with applications or workflows for analysis, storage, and processing. Reusable The ultimate goal of FAIR is to optimise the reuse of data. To achieve this, metadata and data should be well-described so that they can be replicated and/or combined in different settings.

[continues next page]

[34] https://www.fosteropenscience.eu/taxonomy/term/110

[35] https://www.fosteropenscience.eu/taxonomy/term/113

[36] https://op.europa.eu/en/publication-detail/-/publication/9570017e-cd82-11eb-ac72-01aa75ed71a1

[37] Piwowar, H. A., & Vision, T. J. (2013). Data reuse and the open data citation advantage. PeerJ, 1, e175. https://doi.org/10.7717/peerj.175

[38] https://op.europa.eu/en/publication-detail/-/publication/9570017e-cd82-11eb-ac72-01aa75ed71a1

[39] https://www.analitika.ba/publications/transparent-research-and-accessible-data-trend-pay-attention

[40] https://www.go-fair.org/fair-principles/

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Table 6 (continued)**.**

Categorisation matrix category	Open science principle main category	Open science principle sub-category	NOTES
Research Methods	**"OPEN" Reproducible Science**[41] The act of practicing Open Science and the provision of offering to users free access to experimental elements for research reproduction. Open reproducible research can be understood as open methodology[42]	**Transparency and reproducibility of research methods**[43] Methods reproducibility refers to the provision of enough detail about study procedures and data so the same procedures could, in theory or in actuality, be exactly repeated **Transparency and reproducibility of research tools** Methods reproducibility is meant to capture the original meaning of reproducibility, that is, the ability to implement, as exactly as possible, the experimental and computational procedures, with the same data and tools, to obtain the same results.	
Evaluation	**Open Evaluation**[44] An open assessment of research results, not limited to peer-reviewers, but requiring the community's contribution.	**Transparency of research evaluations**[45] An alternative to traditional impact metrics systems, open metrics have developed new way of evaluating the impact of the scholarly outputs. **Content-based evaluation**[46] Do not use journal-based metrics, such as Journal Impact Factors, as a surrogate measure of the quality of individual research articles, to assess an individual scientist's contributions, or in hiring, promotion, or funding decisions. **Transparent peer review**[47] Peer validation process conducted openly on the Internet.	

[continues next page]

[41] https://www.fosteropenscience.eu/taxonomy/term/102

[42] https://www.fosteropenscience.eu/taxonomy/term/102

[43] https://scholar.google.pt/scholar?q=What+does+research+reproducibility+mean%3F&hl=en&as_sdt=0&as_vis=1&oi=scholart

[44] https://www.fosteropenscience.eu/taxonomy/term/128

[45] https://www.fosteropenscience.eu/taxonomy/term/4

[46] https://sfdora.org/read/

[47] https://www.fosteropenscience.eu/taxonomy/term/129

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Table 6 (continued)**.**

Categorisation matrix category	Open science principle main category	Open science principle sub-category	NOTES
Collaboration	**Open Collaboration** …open collaboration as the collaboration between academic researchers and nonacademic actors, including industry, governments, NGOs and individual citizens …Open collaboration within science and with other knowledge actors, including involving citizens, civil society and end-users, such as in citizen science.[48] **Open Collaboration & Citizen Science** CS overlaps with open science (collaboration) in as far as it can be seen to make demands on increasing transparency, inclusivity, and participatory practices in scientific processes. The main difference between CS and OC is the level of professionalism and expertise required to participate in OC projects, in which participation is not merit based, but due to the nature of the research questions requires in practice a certain level of academic experience and acquaintance with scientific work. Key features of the OC method include open coauthorship, remote online collaboration and immediate online sharing of all research outputs.[49] Citizen Science refers to the active participation of people in the co-creation, implementation and evaluation of scientific research[50] Citizen science is not just a participatory way to contribute to scientific knowledge, but also an effective way to address a wide collection of societal challenges.[51]	**Access to research processes** **Access to research infrastructure and tools** *Open science tools* Refers to the tools that can assist in the process of delivering and building on Open Science.[52] (Open Services) Activities offered by organisations and institutions offered free of cost.[53] (Open Science Tools Activities offered by organisations and institutions offered free of cost.) (Open Workflow Tools Apparatuses and services that promote open scientific projects.) **Shared and reciprocated benefits of research** (Open Repositories Open archives that host scientific literature and make their content freely accessible to everyone in the world.)	There is a large literature about open collaboration, covering different areas: • Transdisciplinary research: collaboration between academic and non-academic partners, (OECD, 2020); • University-industry interactions (and geography of innovation): collaboration between academic and commercial partners, often directed and stimulating industrial innovation (d'Este and Perkmann, 2011), including triple helix literature about interactions between universities, industry and government (Etzkowitz and Leydesdorff, 2000); • Citizen science: where individual citizens participate as an active partner in the research process (Irwin, 2002).

[continues next page]

Table 6 (continued)**.**

Categorisation matrix category	Open science principle main category	Open science principle sub-category	NOTES
Education	**Open Education**[54] The European Commission's definition of open education is:	**Open access to educational resources** **Open educational practices**	

[48] https://op.europa.eu/en/publication-detail/-/publication/9570017e-cd82-11eb-ac72-01aa75ed71a1

[49] https://journal.fi/inf/article/view/77414

[50] https://incentive-project.eu/

[51] https://link.springer.com/content/pdf/10.1007/978-3-030-58278-4.pdf

[52] https://www.fosteropenscience.eu/taxonomy/term/134

[53] https://www.fosteropenscience.eu/taxonomy/term/136

[54] https://joint-research-centre.ec.europa.eu/what-open-education_en

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	"a way of carrying out education, often using digital technologies. Its aim is to widen access and participation to everyone by removing barriers and making learning accessible, abundant, and customisable for all. It offers multiple ways of teaching and learning, building and sharing knowledge. It also provides a variety of access routes to formal and non-formal education, and connects" (Opening up Education: A Support Framework for Higher Education Institutions, 2016)		

3.4 PRETESTING (2) the new categorization matrix with the definitions of 3.3

The results of pretest 2 are shown in Table 7. The information included gathers the analysis of two independent researchers and discloses the consensus obtained. Some facts are worth highlighting: the responsible research scope is quite divergent in the different documents: 1) research integrity is included in all; 2) research ethics and open science were found only in Austrian and French Codes; 3) open education explicitly mention only the French Code.

The selected excerpts supporting the marks are presented in appendix 2.

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Table 7. Summary of pretest 2.

Categorisation matrix category	Open science principle main category	Open science principle sub-category	Austrian Code, 2020	French Code, 2017	Danish Code, 2014	Belgian Code, 2009
Publication	Open Access	Access to research publications	**V** s13-s17	**V** s10-11, s14-16, s21		
		Reuse of research publications	**V** s17	**(V)** s5, s16, s18-20		
Research Data	Open Data	Access to and reuse of research data metadata and/or research data	**V** s4-6, s9, s10-12, s17-18, s26-27	**V** s1, s3, s5-s9, s13, s31	**(V)** s4, s6-s8; **V** s12	**(V)** s5, s7
		Importance of research data as a research output and/or as evidence	**(V)** s1, s3-4, s7-9, s28; **V** s26	**V** s2, s4, s8, s13	**(V)** s3-5, s11	**(V)** s1, s3
Research Methods	Reproducible Science	Transparency and reproducibility of research methods	**(V)** s1, s3-4, s8, s15, s17	**V** s2-3, s7, s12, s31	**V** s2; **(V)** s3, s11	**(V)** s5-7
		Transparency and reproducibility of research tools	**(V)** s1, s3-4, s8, s15, s17	**V** s2-3, s7, s12, s31	**V** s2; **(V)** s3, s11	**(V)** s6
Evaluation	Open Evaluation	Transparency of research evaluations and/or peer review	**(V)** s2; **V** s19	**V** s22, s25	**(V)** s10	
		Content-based evaluation	**V** s20	**V** s23-24, s26-28	**(V)** s10	**(V)** s8
Collaboration	Citizen Science & Open Collaboration	Access to research processes and/or research infrastructure and tools	**V** s15	**V** s7, s12	**(V)** s2	
		Shared and reciprocated benefits of research	**V** s21-22, s25, s29	**V** s7, s29-30; **(V)** s32-35	**(V)** s13	**(V)** s2, s9
Communication	Science Communication	Scientific knowledge in universally understandable format	**(V)** s6; **V** s21, S23-24	**V** s17; **(V)** s36	**(V)** s9	**(V)** s4
		Proactive and targeted societal outreach	**V** s21-23	**V** s10, s17, s29-30	**V** s14	**(V)** s2
Education	Open Education			**V** s37		

3.5 PRESENTING OS in Responsible Research National Codes Country-by-Country

The following tables (Tables 8.1 - 8.19) present the results of the analysis of the 19 Responsible Research National Codes. The level of coverage of OS in the different documents is quite different. It should be noted that the documents are diverse in details and in length. An additional note is due – in some cases, there might be also a specific document addressing open science.

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Table 8.1. OS in Responsible Research National Codes – Austria.

1 – AUSTRIA			
OS CATEGORY / NORM	**APPLIES IN CODE**		
Open Access (OA)			
OA – Access to research publications	V		
OA – Reuse of research publications	V		
Open Data (OD)			
OD – Access to and reuse of research data metadata and/or research data	V		
OD – Importance of research data as research output and/or as evidence	V		
Reproducible Science (RS)			
RS – Transparency and reproducibility of research methods	V		
RS – Transparency and reproducibility of research tools	V		
Open Evaluation (OEv)			
OEv – Transparency of research evaluations and/or peer review			
OEv – Content-based evaluation		(V)	
Citizen Science & Open Collaboration (CS&OC)			
CS&OC – Access to research processes and/or research infrastructure and tools		(V)	
CS&OC – Shared and reciprocated benefits of research	V	(V)	
Science Communication (SC)			
SC – Scientific knowledge is universally understandable	V		
SC – Proactive and targeted societal outreach	V		
Open Education (OEd)			
OEd – Open Education			

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Table 8.2. OS in Responsible Research National Codes – Belgium.

2 – BELGIUM			
OS CATEGORY / NORM	**APPLIES IN CODE**		
Open Access (OA)			
OA – Access to research publications			
OA – Reuse of research publications			
Open Data (OD)			
OD – Access to and reuse of research data metadata and/or research data	V		V
OD – Importance of research data as research output and/or as evidence			
Reproducible Science (RS)			
RS – Transparency and reproducibility of research methods		(V)	
RS – Transparency and reproducibility of research tools		(V)	
Open Evaluation (OEv)			
OEv – Transparency of research evaluations and/or peer review			
OEv – Content-based evaluation			
Citizen Science & Open Collaboration (CS&OC)			
CS&OC – Access to research processes and/or research infrastructure and tools			
CS&OC – Shared and reciprocated benefits of research		(V)	
Science Communication (SC)			
SC – Scientific knowledge is universally understandable	V		
SC – Proactive and targeted societal outreach			
Open Education (OEd)			
OEd – Open Education			

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Table 8.3. OS in Responsible Research National Codes – Czech Republic.

3 – CZECH REPUBLIC			
OS CATEGORY / NORM	**APPLIES IN CODE**		
Open Access (OA)			
OA – Access to research publications			
OA – Reuse of research publications			
Open Data (OD)			
OD – Access to and reuse of research data metadata and/or research data			
OD – Importance of research data as research output and/or as evidence			
Reproducible Science (RS)			
RS – Transparency and reproducibility of research methods			
RS – Transparency and reproducibility of research tools			
Open Evaluation (OEv)			
OEv – Transparency of research evaluations and/or peer review			
OEv – Content-based evaluation			
Citizen Science & Open Collaboration (CS&OC)			
CS&OC – Access to research processes and/or research infrastructure and tools			
CS&OC – Shared and reciprocated benefits of research			
Science Communication (SC)			
SC – Scientific knowledge is universally understandable			
SC – Proactive and targeted societal outreach	V		
Open Education (OEd)			
OEd – Open Education			

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Table 8.4. OS in Responsible Research National Codes – Denmark.

4 – DENMARK			
OS CATEGORY / NORM	**APPLIES IN CODE**		
Open Access (OA)			
OA – Access to research publications			
OA – Reuse of research publications			
Open Data (OD)			
OD – Access to and reuse of research data metadata and/or research data		(V)	V
OD – Importance of research data as research output and/or as evidence			
Reproducible Science (RS)			
RS – Transparency and reproducibility of research methods	V	(V)	
RS – Transparency and reproducibility of research tools	V	(V)	
Open Evaluation (OEv)			
OEv – Transparency of research evaluations and/or peer review			
OEv – Content-based evaluation			
Citizen Science & Open Collaboration (CS&OC)			
CS&OC – Access to research processes and/or research infrastructure and tools		(V)	
CS&OC – Shared and reciprocated benefits of research		(V)	
Science Communication (SC)			
SC – Scientific knowledge is universally understandable		(V)	
SC – Proactive and targeted societal outreach	V		
Open Education (OEd)			
OEd – Open Education			

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Table 8.5. OS in Responsible Research National Codes – Estonia.

5 – ESTONIA			
OS CATEGORY / NORM	**APPLIES IN CODE**		
Open Access (OA)			
OA – Access to research publications			
OA – Reuse of research publications			
Open Data (OD)			
OD – Access to and reuse of research data metadata and/or research data	V	(V)	
OD – Importance of research data as research output and/or as evidence			
Reproducible Science (RS)			
RS – Transparency and reproducibility of research methods			
RS – Transparency and reproducibility of research tools			
Open Evaluation (OEv)			
OEv – Transparency of research evaluations and/or peer review			
OEv – Content-based evaluation			
Citizen Science & Open Collaboration (CS&OC)			
CS&OC – Access to research processes and/or research infrastructure and tools			
CS&OC – Shared and reciprocated benefits of research			
Science Communication (SC)			
SC – Scientific knowledge is universally understandable			
SC – Proactive and targeted societal outreach			
Open Education (OEd)			
OEd – Open Education			

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Table 8.6. OS in Responsible Research National Codes – Finland.

6 – FINLAND			
OS CATEGORY / NORM	**APPLIES IN CODE**		
Open Access (OA)			
OA – Access to research publications			
OA – Reuse of research publications			
Open Data (OD)			
OD – Access to and reuse of research data metadata and/or research data			
OD – Importance of research data as research output and/or as evidence			
Reproducible Science (RS)			
RS – Transparency and reproducibility of research methods			
RS – Transparency and reproducibility of research tools			
Open Evaluation (OEv)			
OEv – Transparency of research evaluations and/or peer review			
OEv – Content-based evaluation			
Citizen Science & Open Collaboration (CS&OC)			
CS&OC – Access to research processes and/or research infrastructure and tools			
CS&OC – Shared and reciprocated benefits of research			
Science Communication (SC)			
SC – Scientific knowledge is universally understandable		(V)	
SC – Proactive and targeted societal outreach			
Open Education (OEd)			
OEd – Open Education			

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Table 8.7. OS in Responsible Research National Codes – France.

7 – FRANCE			
OS CATEGORY / NORM	**APPLIES IN CODE**		
Open Access (OA)			
OA – Access to research publications	V		
OA – Reuse of research publications	V		
Open Data (OD)			
OD – Access to and reuse of research data metadata and/or research data	V	(V)	
OD – Importance of research data as research output and/or as evidence	V		
Reproducible Science (RS)			
RS – Transparency and reproducibility of research methods	V		
RS – Transparency and reproducibility of research tools	V		
Open Evaluation (OEv)			
OEv – Transparency of research evaluations and/or peer review			
OEv – Content-based evaluation	V		
Citizen Science & Open Collaboration (CS&OC)			
CS&OC – Access to research processes and/or research infrastructure and tools		(V)	
CS&OC – Shared and reciprocated benefits of research		(V)	
Science Communication (SC)			
SC – Scientific knowledge is universally understandable	V		
SC – Proactive and targeted societal outreach	V		
Open Education (OEd)			
OEd – Open Education	V		

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Table 8.8. OS in Responsible Research National Codes – Germany.

8 – GERMANY			
OS CATEGORY / NORM	**APPLIES IN CODE**		
Open Access (OA)			
OA – Access to research publications			
OA – Reuse of research publications			
Open Data (OD)			
OD – Access to and reuse of research data metadata and/or research data	V	(V)	
OD – Importance of research data as research output and/or as evidence			
Reproducible Science (RS)			
RS – Transparency and reproducibility of research methods		(V)	
RS – Transparency and reproducibility of research tools		(V)	
Open Evaluation (OEv)			
OEv – Transparency of research evaluations and/or peer review			
OEv – Content-based evaluation	V		
Citizen Science & Open Collaboration (CS&OC)			
CS&OC – Access to research processes and/or research infrastructure and tools			
CS&OC – Shared and reciprocated benefits of research			
Science Communication (SC)			
SC – Scientific knowledge is universally understandable			
SC – Proactive and targeted societal outreach			
Open Education (OEd)			
OEd – Open Education			

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Table 8.9. OS in Responsible Research National Codes – Hungary.

9 – HUNGARY			
OS CATEGORY / NORM	**APPLIES IN CODE**		
Open Access (OA)			
OA – Access to research publications		(V)	
OA – Reuse of research publications			
Open Data (OD)			
OD – Access to and reuse of research data metadata and/or research data	V	(V)	
OD – Importance of research data as research output and/or as evidence			
Reproducible Science (RS)			
RS – Transparency and reproducibility of research methods			
RS – Transparency and reproducibility of research tools			
Open Evaluation (OEv)			
OEv – Transparency of research evaluations and/or peer review			
OEv – Content-based evaluation			
Citizen Science & Open Collaboration (CS&OC)			
CS&OC – Access to research processes and/or research infrastructure and tools			
CS&OC – Shared and reciprocated benefits of research		(V)	
Science Communication (SC)			
SC – Scientific knowledge is universally understandable			
SC – Proactive and targeted societal outreach			
Open Education (OEd)			
OEd – Open Education			

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Table 8.10. OS in Responsible Research National Codes – Ireland.

10 – IRELAND			
OS CATEGORY / NORM	**APPLIES IN CODE**		
Open Access (OA)			
OA – Access to research publications			
OA – Reuse of research publications			
Open Data (OD)			
OD – Access to and reuse of research data metadata and/or research data	V	(V)	~~V~~
OD – Importance of research data as research output and/or as evidence			
Reproducible Science (RS)			
RS – Transparency and reproducibility of research methods			
RS – Transparency and reproducibility of research tools		(V)	
Open Evaluation (OEv)			
OEv – Transparency of research evaluations and/or peer review			
OEv – Content-based evaluation			
Citizen Science & Open Collaboration (CS&OC)			
CS&OC – Access to research processes and/or research infrastructure and tools			
CS&OC – Shared and reciprocated benefits of research			
Science Communication (SC)			
SC – Scientific knowledge is universally understandable			
SC – Proactive and targeted societal outreach			
Open Education (OEd)			
OEd – Open Education			

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Table 8.11. OS in Responsible Research National Codes – Italy.

11 – ITALY			
OS CATEGORY / NORM	**APPLIES IN CODE**		
Open Access (OA)			
OA – Access to research publications			
OA – Reuse of research publications			
Open Data (OD)			
OD – Access to and reuse of research data metadata and/or research data			
OD – Importance of research data as research output and/or as evidence			
Reproducible Science (RS)			
RS – Transparency and reproducibility of research methods		(V)	
RS – Transparency and reproducibility of research tools		(V)	
Open Evaluation (OEv)			
OEv – Transparency of research evaluations and/or peer review			
OEv – Content-based evaluation			
Citizen Science & Open Collaboration (CS&OC)			
CS&OC – Access to research processes and/or research infrastructure and tools			
CS&OC – Shared and reciprocated benefits of research			
Science Communication (SC)			
SC – Scientific knowledge is universally understandable			
SC – Proactive and targeted societal outreach		(V)	
Open Education (OEd)			
OEd – Open Education			

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Table 8.12. OS in Responsible Research National Codes – Latvia.

12 – LATVIA			
OS CATEGORY / NORM	**APPLIES IN CODE**		
Open Access (OA)			
OA – Access to research publications			
OA – Reuse of research publications			
Open Data (OD)			
OD – Access to and reuse of research data metadata and/or research data			
OD – Importance of research data as research output and/or as evidence			
Reproducible Science (RS)			
RS – Transparency and reproducibility of research methods			
RS – Transparency and reproducibility of research tools			
Open Evaluation (OEv)			
OEv – Transparency of research evaluations and/or peer review			
OEv – Content-based evaluation			
Citizen Science & Open Collaboration (CS&OC)			
CS&OC – Access to research processes and/or research infrastructure and tools			
CS&OC – Shared and reciprocated benefits of research			
Science Communication (SC)			
SC – Scientific knowledge is universally understandable			
SC – Proactive and targeted societal outreach	V		
Open Education (OEd)			
OEd – Open Education			

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Table 8.13. OS in Responsible Research National Codes – Netherlands.

13 – NETHERLANDS			
OS CATEGORY / NORM	**APPLIES IN CODE**		
Open Access (OA)			
OA – Access to research publications			
OA – Reuse of research publications			
Open Data (OD)			
OD – Access to and reuse of research data metadata and/or research data	V	(V)	
OD – Importance of research data as research output and/or as evidence			
Reproducible Science (RS)			
RS – Transparency and reproducibility of research methods	V		
RS – Transparency and reproducibility of research tools	V		
Open Evaluation (OEv)			
OEv – Transparency of research evaluations and/or peer review			
OEv – Content-based evaluation			
Citizen Science & Open Collaboration (CS&OC)			
CS&OC – Access to research processes and/or research infrastructure and tools			
CS&OC – Shared and reciprocated benefits of research			
Science Communication (SC)			
SC – Scientific knowledge is universally understandable		(V)	
SC – Proactive and targeted societal outreach			
Open Education (OEd)			
OEd – Open Education			

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Table 8.14. OS in Responsible Research National Codes – Poland.

14 – POLAND			
OS CATEGORY / NORM	**APPLIES IN CODE**		
Open Access (OA)			
OA – Access to research publications			
OA – Reuse of research publications			
Open Data (OD)			
OD – Access to and reuse of research data metadata and/or research data	V	(V)	~~V~~
OD – Importance of research data as research output and/or as evidence			
Reproducible Science (RS)			
RS – Transparency and reproducibility of research methods	V		
RS – Transparency and reproducibility of research tools	V		
Open Evaluation (OEv)			
OEv – Transparency of research evaluations and/or peer review			
OEv – Content-based evaluation			
Citizen Science & Open Collaboration (CS&OC)			
CS&OC – Access to research processes and/or research infrastructure and tools			
CS&OC – Shared and reciprocated benefits of research		(V)	
Science Communication (SC)			
SC – Scientific knowledge is universally understandable	V		
SC – Proactive and targeted societal outreach			
Open Education (OEd)			
OEd – Open Education			

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Table 8.15. OS in Responsible Research National Codes – Spain.

15 – SPAIN			
OS CATEGORY / NORM	**APPLIES IN CODE**		
Open Access (OA)			
OA – Access to research publications	V		
OA – Reuse of research publications			
Open Data (OD)			
OD – Access to and reuse of research data metadata and/or research data	V	(V)	V
OD – Importance of research data as research output and/or as evidence			
Reproducible Science (RS)			
RS – Transparency and reproducibility of research methods		(V)	
RS – Transparency and reproducibility of research tools		(V)	
Open Evaluation (OEv)			
OEv – Transparency of research evaluations and/or peer review			
OEv – Content-based evaluation	V		
Citizen Science & Open Collaboration (CS&OC)			
CS&OC – Access to research processes and/or research infrastructure and tools			
CS&OC – Shared and reciprocated benefits of research			
Science Communication (SC)			
SC – Scientific knowledge is universally understandable	V		
SC – Proactive and targeted societal outreach			
Open Education (OEd)			
OEd – Open Education			

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Table 8.16. OS in Responsible Research National Codes – Sweden.

16 – SWEDEN			
OS CATEGORY / NORM	**APPLIES IN CODE**		
Open Access (OA)			
OA – Access to research publications	V		
OA – Reuse of research publications			
Open Data (OD)			
OD – Access to and reuse of research data metadata and/or research data	V	(V)	V
OD – Importance of research data as research output and/or as evidence			
Reproducible Science (RS)			
RS – Transparency and reproducibility of research methods		(V)	
RS – Transparency and reproducibility of research tools		(V)	
Open Evaluation (OEv)			
OEv – Transparency of research evaluations and/or peer review			
OEv – Content-based evaluation			
Citizen Science & Open Collaboration (CS&OC)			
CS&OC – Access to research processes and/or research infrastructure and tools			
CS&OC – Shared and reciprocated benefits of research		(V)	
Science Communication (SC)			
SC – Scientific knowledge is universally understandable			
SC – Proactive and targeted societal outreach			
Open Education (OEd)			
OEd – Open Education			

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Table 8.17. OS in Responsible Research National Codes – Norway.

17 – NORWAY			
OS CATEGORY / NORM	**APPLIES IN CODE**		
Open Access (OA)			
OA – Access to research publications	V		
OA – Reuse of research publications			
Open Data (OD)			
OD – Access to and reuse of research data metadata and/or research data			
OD – Importance of research data as research output and/or as evidence			
Reproducible Science (RS)			
RS – Transparency and reproducibility of research methods			
RS – Transparency and reproducibility of research tools			
Open Evaluation (OEv)			
OEv – Transparency of research evaluations and/or peer review			
OEv – Content-based evaluation			
Citizen Science & Open Collaboration (CS&OC)			
CS&OC – Access to research processes and/or research infrastructure and tools			
CS&OC – Shared and reciprocated benefits of research			
Science Communication (SC)			
SC – Scientific knowledge is universally understandable			
SC – Proactive and targeted societal outreach	V		
Open Education (OEd)			
OEd – Open Education			

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Table 8.18. OS in Responsible Research National Codes – United Kingdom.

18 – UNITED KINGDOM			
OS CATEGORY / NORM	**APPLIES IN CODE**		
Open Access (OA)			
OA – Access to research publications			
OA – Reuse of research publications			
Open Data (OD)			
OD – Access to and reuse of research data metadata and/or research data	V	(V)	
OD – Importance of research data as research output and/or as evidence			
Reproducible Science (RS)			
RS – Transparency and reproducibility of research methods	V		
RS – Transparency and reproducibility of research tools			
Open Evaluation (OEv)			
OEv – Transparency of research evaluations and/or peer review			
OEv – Content-based evaluation			
Citizen Science & Open Collaboration (CS&OC)			
CS&OC – Access to research processes and/or research infrastructure and tools			
CS&OC – Shared and reciprocated benefits of research			
Science Communication (SC)			
SC – Scientific knowledge is universally understandable			
SC – Proactive and targeted societal outreach			
Open Education (OEd)			
OEd – Open Education			

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Table 8.19. OS in Responsible Research National Codes – Switzerland.

19 – SWITZERLAND			
OS CATEGORY / NORM	**APPLIES IN CODE**		
Open Access (OA)			
OA – Access to research publications	V		
OA – Reuse of research publications			
Open Data (OD)			
OD – Access to and reuse of research data metadata and/or research data			
OD – Importance of research data as research output and/or as evidence			
Reproducible Science (RS)			
RS – Transparency and reproducibility of research methods		(V)	
RS – Transparency and reproducibility of research tools	V		
Open Evaluation (OEv)			
OEv – Transparency of research evaluations and/or peer review			
OEv – Content-based evaluation			
Citizen Science & Open Collaboration (CS&OC)			
CS&OC – Access to research processes and/or research infrastructure and tools			
CS&OC – Shared and reciprocated benefits of research			
Science Communication (SC)			
SC – Scientific knowledge is universally understandable			
SC – Proactive and targeted societal outreach			
Open Education (OEd)			
OEd – Open Education			

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3.6 PRESENTING OS in Responsible Research National Codes by OS Principle Main Category

In the following section the results from the content analysis of each category selected are presented. For the sake of clarity the list of identified references for each category is detailed in appendix 3.

OPEN ACCESS

Open Access, as previously defined, "refers to online, free of cost access to peer reviewed scientific content with limited copyright and licensing restrictions". Two subcategories/norms were identified **"ACCESS TO RESEARCH PUBLICATIONS"** and **"REUSE OF RESEARCH PUBLICATIONS"**; the following definitions have been used for these subcategories/norms: "Open Access to research publications refers to online, free of cost access to peer reviewed scientific content with limited copyright and licensing restrictions."

For the sake of consistency with the methodology defined for this task, the two subcategories have been subject to analysis. However, since reuse is only identified in two Codes (FRANCE and AUSTRIA), these subcategories could be merged to "Access and Reuse to/of research publications". In fact, reuse is extensively detailed in the French Code; recommendations regarding the use of "DOI", "deposit of publications in scientific social networks", "transference of copyright to a publisher", and the reuse of "The published images and illustrations" have been detailed. The Austrian Code also mentions reuse "The publications (including the underlying research data and materials as well as the corresponding metadata) in the form of journal articles, monographs, anthologies, proceedings, or similar publications are made available on a permanent and open basis under an open license for easy reuse."

Seven of the Codes mentioned open publication (SPAIN, SWEDEN, NORWAY, SWITZERLAND, FRANCE, AUSTRIA and HUNGARY) mainly to underline their support to open-access publication. Only two of the Codes (SWEDEN and FRANCE) provided direct advice on the process of publishing and the availability of publications. Details on open science advantages, funding policy by the Swedish Research Council on open science, and self-archiving were included. It should be underlined that only in the Swedish Code provided references regarding the impacts of open publications to researchers' evaluation "open publication being counted as a merit in the evaluation and recruitment of researchers" (SWEDEN). The French Code provides detailed information on the requirements regarding open science due to the "French Digital Republic Act", and provide some recommendations regarding the use of "Multidisciplinary repository platforms such as ArXiv, HAL (Hyper Articles en Ligne) and bioRxiv", the use of "scientific social networks" to facilitate the "communication between researchers and give their work visibility", and about "Depositing articles in open archives".

Both of these Codes and the AUSTRIAN one, assume the term "publication" in a broad sense: "Publication means any act that makes research findings public through journals, conference proceedings, open archives, blogs, websites, tweets, etc.". The other Codes, in concordance with the results from Laine, that stated that "the term is used in the traditional sense, excluding e.g. data outputs, videos, blogs, and publications popularising science" seem to assume publication in a more strict sense.

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OPEN DATA

Open Data as previously defined "are online, free of cost, accessible data that can be used, reused and distributed provided that the data source is attributed and shared alike that in terms of norms could be translate"[55] as the **"ACCESS TO AND REUSE OF RESEARCH DATA METADATA AND/OR RESEARCH DATA"** which means "Online and free of cost data supported with terms that allow reuse and redistribution". Horizon Europe requires that "…responsible research data management so that data are Findable, Accessible, Interoperable and Re-usable (FAIR)". No references have been found regarding the CARE principles for indigenous data governance[56]. The so-called FAIR Principles For Research Data And Metadata includes:

Findable Metadata and data should be easy to find for both humans and computers.
Accessible Once the user finds the required data, she/he/they need to know how they can be accessed
Interoperable The data usually need to be integrated with other data. In addition, the data need to interoperate with applications or workflows for analysis, storage, and processing.
Reusable The ultimate goal of FAIR is to optimise the reuse of data. To achieve this, metadata and data should be well-described so that they can be replicated and/or combined in different settings.

Therefore, data will be made 'as open as possible, but will be allowed to stay as closed as necessary', safeguarding legitimate interests or constraints. However, access to research outputs shall be provided for third parties to be able to verify or validate publications.

The subcategory **"IMPORTANCE OF RESEARCH DATA AS A RESEARCH OUTPUT AND/OR AS EVIDENCE"** included "The sharing of all research outputs, including data, code, materials, and other types of information beyond the traditional research paper has the potential to aid the advancement of scientific progress generally and benefit individual researchers by adding transparency to their research process as well as potentially increasing citations to their work". However, as stated by Hofmann (2022), to enhance OS, it is crucial that we pay attention to the existence of an incentive structure. Therefore, adaptive adjustments to the impact metrics are deemed necessary. Indeed, despite recommendations and requirements on open data in 4 of the Codes under analysis, only one reference has been found to incentive researchers or other stakeholders that will follow open data strategy: "Open access of publications and data should be used as a separate category of research performance and assessed positively." (AUSTRIA).

The other reference on how open science practices should be taken into account on researcher´s evaluation has been identified in the Swedish Code, regarding open publication ""open publication being counted as a merit in the evaluation and recruitment of researchers". (SWEDEN).

Most of the Codes detailed the issues regarding data. However, only 4 Codes (SWEDEN (2017), AUSTRIA (2020), UK (2019) and GERMANY (2022)) explicitly mention open data and present some recommendations on this issue. In order to try some potential explanation for these results, some dates have to be considered: (1) the European Code of Conduct for Research Integrity (ECoC) was

[55] https://www.fosteropenscience.eu/taxonomy/term/110

[56] Carroll, S. R., Garba, I., Figueroa-Rodríguez, O. L., Holbrook, J., Lovett, R., Materechera, S., ... & Hudson, M. (2020). The CARE principles for indigenous data governance.

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published in 2017), (2) the EU General Data Protection Regulation went into effect on May 25, 2018, replacing the Data Protection Directive 95/46/EC and the EU Open Science Policy has been published in 2019.

Both French and Austrian Codes (2019, 2020) include detailed information on open data policy and provided some information on “inappropriate data management practices”. The French Code (FRANCE) is more detailed on the legal background and the Austrian Code (AUSTRIA) explicitly mentioned the need for compliance with FAIR principles. In addition, this Code also recommends the access to metadata “a key component in the verifiability and reproducibility of research results”. The UK Concordat (2021) underlines the importance of “transparency and open communication in the in the reporting of research data collection methods; in the analysis and interpretation of data; in making research findings widely available” and requires that institutions and funding organisations “enable access to a storage infrastructure for these data”, and “communicate their data management requirements and comply with the FAIR principles”. The same approach has been identified in the Code from GERMANY.

The other Codes that mentioned data management details (IRELAND (2019), SWEDEN, (2017), NETHERLANDS (2018), SPAIN (2021) and HUNGARY (2010)) seem to reflect the tension regarding the recommendation “as open as possible, as closed as necessary”. Indeed, most of these Codes, with exception of the Spanish Code, have been drafted before the publication of the EU Open Science Policy and, therefore, follow the requirements of GDPR regarding data management. The Irish Code (IRELAND) clearly identified this tension, stating that “The “National Framework on the Transition to an Open Research Environment” underlines the importance of making research data “as open as possible, as restricted as necessary”. Open access to research data should lead to greater integrity in the gathering, analysis and presentation of data as it may be open to scrutiny by peers, globally. It should also facilitate reuse of data for further research, contribute to public knowledge and inform policy and practice. “

Other Codes seems follows a more discrete position regarding data management stating that:

“as far as possible, data, software codes, protocols, research material and corresponding metadata can be stored permanently.” (NETHERLANDS).

“The research institution should have in place a policy on the retention of primary materials and data. The policy must include information on the methods of archiving, safeguarding and safe forms of disposal or utilisation of materials after the required retention period... Furthermore, the institution must protect archived materials against damage and unauthorised access, in compliance with the regulation on the protection of personal data, with specific emphasis on the protection of sensitive data (POLAND).

“In addition to the EU General Data Protection Regulation, which will apply with legal force in Sweden, work is in progress on national supplementary legislation, and a further special regulation focusing on the handling of research data. Ultimately, it concerns the requirements set for permitting personal data handling for research purposes” (SWEDEN).

“The researcher ensures as broad access to data as possible, considering the substantiated limitations of access to the data resulting from the need to protect personal data...” (CZECK REPUBLIC).

“Denial of handover of data to other researchers causing failure of the reconstruction of experimental results can be mentioned here. Improper storage of original data, alteration of data, neglecting data disturbing the outcome desired, distortion of data, and ignoring unexpected results can also be reckoned with here.” (HUNGARY).

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Time restriction for storage of data has been mentioned in the Belgian and Danish Code:

"Researchers' work is deemed to be verifiable when it allows colleagues to follow the progress of the research and to reproduce it, if need be, but "The primary data of a research project and the protocols must be kept and made accessible during a determined and sufficient period of time."" (BELGIUM).

"...data should in general be kept for a period of at least five years from the date of publication." (DENMARK).

As identified by the official portal for European data[57]: "there is still a misunderstanding about how protecting data and opening data can pursue the same goal. Some even claim GDPR is controversial to the concept of Open Data. GDPR deals exclusively with personal data. The only situation when GDPR directly affects Open Data is when Open Data includes personal data. According to GDPR, European citizens must give their clear and explicit consent to the processing of their data. Therefore, no personal data can be published for re-use without the consent of the affected party. There are a few exceptions, when personal data can be published:

1. If there are legitimate reasons to publish data. For example, in the case of a court decision. This rule restricts privacy rights in general.

2. If the data has been anonymized.

Anonymization is the process of removing personally identifiable information from data. Therefore, these data can no longer be referred to as "personal data" and is no longer subject to GDPR. By ensuring that personal data is processed transparent, strictly following GDPR, it can lower the barrier to publish and re-use Open data. Therefore, GDPR can facilitate the data-driven economy, generating new products and services that create value to society, while respecting the rights of citizens."

REPRODUCIBLE SCIENCE

In line with the definition previously described "The act of practicing Open Science and the provision of offering to users free access to experimental elements for research reproduction. Open reproducible research can be understood as open methodology". Therefore, this may include the following subcategories: **"TRANSPARENCY AND REPRODUCIBILITY OF RESEARCH METHODS"** that "refers to the provision of enough detail about study procedures and data so the same procedures could, in theory or in actuality, be exactly repeated.", and **"TRANSPARENCY AND REPRODUCIBILITY OF RESEARCH TOOLS"** that is, the ability to implement, as exactly as possible, the experimental and computational procedures, with the same data and tools, to obtain the same results".

Six of the Codes, out of 12, explicitly support the reproducibility (SWEDEN, SWITZERLAND, AUSTRIA), reliability (SWITZERLAND, FRANCE, GERMANY), verifiability (SWITZERLAND), accuracy (SWITZERLAND), credibility (DENMARK) of science. Nevertheless, the aforementioned Codes, do not refer to the openness of methods. The only exception is the Code from Denmark that

[57] https://data.europa.eu/en/publications/datastories/protecting-data-and-opening-data

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explicitly mentioned Openness ("To ensure the credibility of scientific reasoning and to ensure that academic reflection is consistent with practice in the relevant field of research, all phases of research should be transparent. This requires openness when reporting: • conflicts of interest • planning of research • research methods applied • results and conclusions").

In the other six Codes, the references to openness are even more vague. These findings are, in accordance with the results found by Laine[58] in the ALLEA ECoC, in which the means to increase reproducibility include: (1) is made the researchers' responsibility in reporting their results "Experimental studies must also be presented in such a way that their reproducibility can be tested. The researcher should report all variables and conditions included in the study." (SWEDEN); "Precise documentation of a high quality study design ensures the reproducibility and thus the credibility of research results." (AUSTRIA) or by placing the responsibility for providing the proper research infrastructures for reproducibility on research institutions and organisations ("the relevant regulations to ensure their reproducibility and/or verifiability (depending on the discipline), reliability, and accuracy. Institutions and funding organisations should provide or enable access to a storage infrastructure for these data possible – as long as there are no important reasons to the contrary – for research results to be verified"). (SWEDEN); Institutions and funding organisations should provide or enable access to a storage infrastructure for these data. (SWITZERLAND).

Also, transparency and other related terms (traceability, clear and explicit) have been found in different Codes; Code of SWITZERLAND states that Reliability involves both transparency and traceability: "Reliability is reflected in particular in the design, methodology, and analysis of research; it involves both transparency and traceability.", and the French Code requires that "Data production procedures must be described in terms so they can be replicated by other researchers and re-used." (FRANCE).

Transparency has also been found in other Codes: "Transparency means, among other things, ensuring that it is clear to others what data the research was based on, how the data were obtained, what and how results were achieved and what role was played by external…" (NETHERLANDS); "Transparency means ensuring that it is clear what data, materials, and methods the research was based on and how the results were achieved. The line of reasoning must be clear, and the individual steps in the research process must be verifiable." (AUSTRIA) and "transparency and open communication in declaring potential competing interests; in the reporting of research data collection methods." (UNITED KINGDOM).

A more discrete approach about open methods has been found in the other 6 Codes (IRELAND, NETHERLANDS, ITALY, GERMANY, POLAND, SPAIN, SWEDEN) (e,g,: " adequate access to them for a reasonable time period" (POLAND); "in a manner consistent with practices within the field of research" (GERMANY); "Materials and methods must be described with sufficient clarity and detail". (SWEDEN)).

Within this category it is important to include some reflections regarding the definitions. The concepts of TRANSPARENCY, ACCOUNTABILITY, OPENNESS, TRACEABILITY, REPRODUCIBILITY, RELIABILITY, CREDIBILITY, ACCURACY, TRUST have been presented in different Codes. First of all, let's start with the definitions presented in the literature and in the Cambridge Dictionary.

[58] Laine, H. (2018). Open science and codes of conduct on research integrity. *Informaatiotutkimus*.

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TRANSPARENCY and OPENNESS[59] are core values of academic research and are essential if new observations and discoveries are to fully contribute to advances in global knowledge.

TRANSPARENCY means that readers are able to determine how data and other materials have been created and interpreted by authors, that readers have information about how they can access these materials, and that readers have sufficient information to be able to interpret and re-use the materials.

OPENNESS means that the materials are available to other researchers with as few barriers as possible.

ACCOUNTABILITY[60] is the fact of being responsible for what you do and able to give a satisfactory reason for it, or the degree to which this happens.

TRACEABILITY[61] is the ability to find or follow something.

CREDIBILITY[62] is the fact that someone can be believed or trusted.

ACCURACY[63] is the fact of being exact or correct.

REPRODUCIBILITY[64] mean consistent results from specific data.

REPLICABILITY mean consistent results across different studies.

And the way these definitions are presented within the different Codes:

“TRANSPARENCY means, among other things, ensuring that it is clear to others what data the research was based on, how the data were obtained, what and how results were achieved and what role was played by external” (NETHERLANDS).

“ACCOUNTABILITY in the conduct of research – researchers are expected to carry out their work in a diligently planned and possibly faultless manner. To ensure that these conditions are met, it is necessary to ensure: measurability in research planning, ability to select the appropriate research methods and methods applicable to the analysis of results, the exactness of measurements and compliance with relevant regulations and procedures.” (POLAND).

“OPENNESS when reporting: • conflicts of interest • planning of research • research methods applied • results and conclusions (DENMARK).

“The RELIABILITY of data produced by researchers relies on the implementation of appropriate research protocols taking into account acquired and proven knowledge. Data production procedures

[59] https://www.cambridge.org/core/open-research/transparency-and-openness

[60] https://dictionary.cambridge.org/dictionary/english/accountability

[61] https://dictionary.cambridge.org/dictionary/english/traceability?q=TRACEABILITY

[62] https://dictionary.cambridge.org/dictionary/english/credibility?q=CREDIBILITY

[63] https://dictionary.cambridge.org/dictionary/english/accuracy?q=ACCURACY

[64] Hofmann, B. (2022). Open Science Knowledge Production: Addressing Epistemological Challenges and Ethical Implications. Publications, 10(3), 24.

[64] Hofmann, B. (2022). Open Science Knowledge Production: Addressing Epistemological Challenges and Ethical Implications. Publications, 10(3), 24

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must be described in clear and explicit terms so they can be replicated by other researchers and re-used." (FRANCE).

"TRACEABILITY defines all the information on data production conditions (methods, dates, etc.)" (FRANCE).

"RELIABILITY in ensuring the quality of research and teaching in order to maximise the CREDIBILITY of, and TRUST in, science." (SWITZERLAND).

RELIABILITY is reflected in particular in the design, methodology, and analysis of research; it involves both TRANSPARENCY and TRACEABILITY". (SWITZERLAND)

"ensure their REPRODUCIBILITY and/or VERIFIABILITY (depending on the discipline), RELIABILITY, and ACCURACY". (SWITZERLAND).

"TRANSPARENCY means ensuring that it is clear what data, materials, and methods the research was based on and how the results were achieved". (AUSTRIA).

"Precise documentation of a high quality study design ensures the REPRODUCIBILITY and thus the CREDIBILITY of research results". (AUSTRIA).

Ambiguity warning: these words are used in various ways in the different Codes. Even if the objective of this task is not the analysis of the aforementioned definitions it is important to emphasise that the strategies, norms, and rules for open science are expressions of the principles and values of open science.

As previously identified[65], in Codes of conduct for scientific research, the concepts of values and norms are often used interchangeably. Yet, it is crucial to distinguish between the two concepts. Values are general ideals. They underlie norms, which are action-guiding rules. Indeed, principles are a subset of values that appear to be unquestionable. Therefore, as explained in the conclusion we will consider open science values instead of principles.

The values (instrumental values) of TRANSPARENCY, OPENNESS, ACCOUNTABILITY AND TRACEABILITY and their associated norms (open access, open data, open methods…) increase scientific CREDIBILITY by allowing research to be more REPRODUCIBLE and RELIABLE that may increase the integrity and trust (intrinsic values) in science.

[65] https://embassy.science/wiki/Theme:B4f7b2e3-af61-4466-94dc-2504affab5a8

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OPEN EVALUATION

The previously described definitions were used for the analysis. OPEN EVALUATION has been defined as "An open assessment of research results, not limited to peer-reviewers, but requiring the community's contribution." The following two sub-categories have been used: **"TRANSPARENCY OF RESEARCH EVALUATIONS AND/OR PEER REVIEW"** – "Research evaluation and peer validation process conducted openly." **"CONTENT-BASED EVALUATION"** – "Do not use journal-based metrics, such as Journal Impact Factors, as a surrogate measure of the quality of individual research articles, to assess an individual scientist's contributions, or in hiring, promotion, or funding decisions."

None of the Codes mention explicitly openness in the context of research evaluation methods. What the French Code does recognise as an openness-related issue is the need for transparency on the recommendations for scientific evaluators "conclusions must be explained and justified" (FRANCE). Regarding Content Based Evaluation only four of the Codes mention the issue: "Under no circumstances shall the evaluation be based solely on bibliometric criteria." (SPAIN); "Base assessment of individual researchers on a qualitative judgment of their portfolio." (FRANCE); "To assess the performance of researchers, a multidimensional approach is called for…" (GERMANY). The Austrian Code presents a more conditional approach to the issue: "In general, the assessment of research performance should focus primarily on the quality of the research. If non-research related factors are used, these must be explained and be made transparent." (AUSTRIA).

CITIZEN SCIENCE & OPEN COLLABORATION

In line with the definition previously presented "Open collaboration within science and with other knowledge actors, including involving citizens, civil society and end-users, such as in citizen science." Citizen Science refers to the active participation of people in the "co-creation, implementation and evaluation of scientific research" only the AUSTRIAN Code clearly refers this issue:

"Other ways of involving the non-scientific public are participatory approaches, such as citizen science, citizens' conferences, or participatory technology assessment, which are characterised by the active inclusion of practical knowledge and/or interested citizens in the carrying out of research projects.

Citizen science or other similar transdisciplinary approaches should be used especially in situations where they are a suitable method for answering research questions. In addition, efforts can be made to find new approaches for involving the public in research funding in an appropriate manner. Ideally, this would not only make science and research more transparent but also more understandable. This, in turn, helps the public to make connections between science and research and their lives."

All the other Codes do not recognise citizens' rights to participate in the research process, or even its possibility. None of them mention citizens, either as individuals, or as a stakeholder group participation in scientific activities. As mentioned by Laine "This is the case even with the European code, which names the European Association on Citizen Science (ECSA) as one of the consulted stakeholder representatives."

Due to the lack of explicit references regarding citizen science the two categories/norms defined for the analysis **"ACCESS TO RESEARCH PROCESSES AND/OR RESEARCH INFRASTRUCTURE AND TOOLS"** and **"SHARED AND RECIPROCATED BENEFITS OF RESEARCH"** do not seem clarifying. This may be justified since for the first category the results identified are mainly related to the openness of "all phases of research should be transparent" in general terms and not specifically to citizens, In that sense this issue is already covered in other categories. In the same line, for the

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"Shared And Reciprocated Benefits of Research", the issues identified are mainly related with the demands made in all of the Codes for equally shared responsibility among all authors when publishing research results or with "researchers' responsibility to society"; both issues, however, are not related with citizen science or are covered in other category.

Given the main focus of the Codes is on research integrity, the use of open collaboration together with citizen science is problematic. Therefore, in future analysis only citizen science, without any subcategories, should be used.

SCIENCE COMMUNICATION

Six of the Codes addressed **"PROACTIVE AND TARGETED SOCIETAL OUTREACH"** in some way: "A scientist must use their knowledge, intellect and authority for the benefit of the community." (ITALY); "Openness regarding research findings is essential […] for returning some benefit to the research participants and society in general, and for ensuring a dialogue with the public. Such communication is also a function of democracy." (NORWAY); "Publication and communication are essential for enabling the research community to scrutinize and discuss research results." (DENMARK); "Researchers are ethically obliged to make their research findings available to both the scientific community and the public. (FRANCE); "it is recommended to involve the non-scientific public in an open and transparent manner. Such involvement is also important because research results can have a wide range of implications for society and each individual." (AUSTRIA); or "publishes with the aim to pass on the results and knowledge to the professional public" (CZECH REPUBLIC).

"SCIENTIFIC KNOWLEDGE IS UNIVERSALLY UNDERSTANDABLE" is addressed in eight Codes. Some make explicit references: "ensure that their research results are made known to society at large in such a way that they can be understood by non-specialists" (POLAND); "Accessible and objective language shall be used in such a way that it can be understood by the non-specialised public and shall avoid distortion and sensationalist overstatement, as well as the improper disclosure of personal data." (SPAIN); "In media communications or presentations, the researcher must present his/her research results in a truthful and comprehensible way." (BELGIUM); "Researchers must make their knowledge and research activities available to the public, so that nonexperts can understand the evidence and advantages" (FRANCE); "Science communication is an instrument suited for achieving these goals. This includes, in particular, the generally understandable communication of complex scientific content for an interested non-scientific audience." (AUSTRIA), even if some of them do not tackle clearly the requirement of being understandable: "Be honest in public communication" (NETHERLANDS); "Although form, expression and level of detail may differ according to channels employed and audiences addressed, the standards for responsible conduct of research should always be respected when communicating research." (DENMARK); "misleading the general public by publicly presenting deceptive or distorted information concerning one's own research results or the scientific importance or applicability of those results" (FINLAND). Some Codes offer examples on how to make science more understandable and appealing to audiences beyond the research community: "Communication is a form of conveying research results to society at large, usually in the spoken form, often with the use of media" (POLAND); "Scientific information disseminated through social networks and internet portals must be proven, verified, updated and contextualized as required by scientific communication." (SPAIN); "Research can be communicated through various channels ranging from strictly professional contexts aimed at peers to more popular research communication aimed at a broader audience." (DENMARK); "Social networks and blogs are becoming an increasingly key source of information for

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the public and the media." (FRANCE); "Researchers and research institutions should be encouraged to use different channels to address as wide a public as possible and raise their interest in science and research while at the same time being open to feedback from this same public." (AUSTRIA) and as a form of avoiding "unjustified fears or hopes." (BELGIUM); "false information with their scholarly expertise" (AUSTRIA).

OPEN EDUCATION

In line with the European Commission's definition previously described "a way of carrying out education, often using digital technologies. Its aim is to widen access and participation to everyone by removing barriers and making learning accessible, abundant, and customisable for all. It offers multiple ways of teaching and learning, building and sharing knowledge. It also provides a variety of access routes to formal and non-formal education, and connects"[66] only the FRENCH Code clearly refers this subject:

"Teaching materials are copyright-protected. Authors can choose between different levels of protection for each teaching material using an appropriate CC licence. The re-use of materials for teaching or research purposes is permitted within the scope of the educational exception" (FRANCE).

Issues regarding education, other than training in research integrity, have been included in any of the other Codes.

[66] https://joint-research-centre.ec.europa.eu/what-open-education_en

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3.6.1 On the use of terms openness and transparency

The frequency of the use of terms *openness* (open*) and *transparency* was analysed with stemmed words (open* and transparent*), following the approach by Laine (2018). Figure # presents these results. For the ease of reading the graph, the publication year of each of the 19 Responsible Research National Code was included.

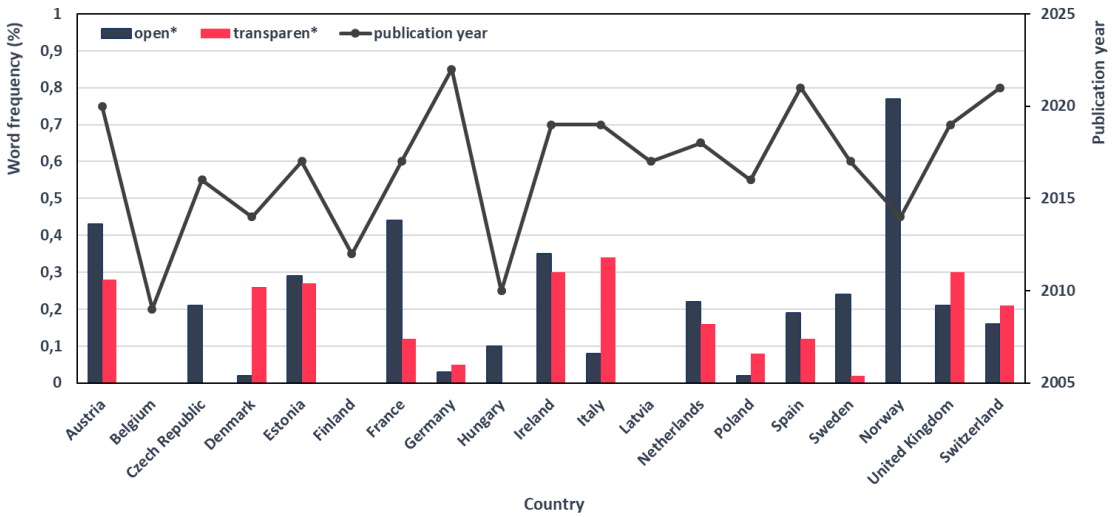

Figure 2. Word frequencies for the terms openness and transparency (stemmed words).

As expected, the use of transparency and openness seems to be more prevalent in more recent codes. However, no specific correlations could be established.

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4 Concluding remarks

Codes of conduct can be framed within the idea of responsibility. The concept is heterogeneous in the sense that we can consider several dimensions: the legal, the social, the moral, the professional, the political, and the historical. Moreover, responsibility could be understood at different levels – individual, institutional and societal – and in diverse contexts – "to assume responsibility", "to attribute responsibility", "to have responsibility" or, in a normative meaning, "to be a responsible person" [67].

In the scope of ethics in research, responsibility is a key aspect and Codes of conduct – normative, conveying rules with which researchers and research institutions ought to comply – are deemed to clarify the meaning of responsible research and of responsible individual/institution. Codes have been described as normative also in the more specific sense of attributing responsibility to particular actors[68], even though the articulation of different levels of responsibility (individual or institutional) might not be clear[69];

Mainly from our results regarding the analysis of different EU national Codes of conduct concerning research integrity, some notes are due:

1. As pointed out with regards to open science[70], the layers of confusion surrounding responsible research rival a millefeuille. Responsibility in research is spread across so many areas (research ethics, research integrity, open science, responsible research and innovation, science communication) that it is difficult to define what a responsible investigator is;
2. Also, as far as we were able to assess with our results, these areas are usually treated independently; for the corpus of analysis in pretest 1 and 2, only in the Austrian and the French Codes do these issues have been treated within the same document.

[67] Teixeira, C. M., Carvalho, A. S., & Pereira, S. M. (2018). Responsibility: From its conceptual foundations to its practical application in intensive care units. *Acta Bioethica*, *24*(1), 47-56. http://dx.doi.org/10.4067/S1726-569X2018000100047

[68] Valkenburg, G., Dix, G., Tijdink, J. *et al.* (2020) Making researchers responsible: attributions of responsibility and ambiguous notions of culture in research codes of conduct. *BMC Medical Ethics* 21, 56. https://doi.org/10.1186/s12910-020-00496-0

[69] *Ibid*.

[70] Mirowski, P. (2018) The future(s) of open science. Social Studies of Science, 48(2), 171-203.

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3. None of the evaluated Codes are in contradiction with the values of open science, but only the Austrian and French Codes of conduct can be said to actively support the values and norms of open science. This may be justified since both Codes have been issued or updated after EU Open Science Policy (2019). Also open science discussion was already in the science policy mainstream in Europe during its drafting, and was a high priority for the European Commission, which has since adopted the Code for projects funded through its Horizon 2020 and Horizon Europe instruments.
4. However, even if some other Codes have been published or updated after 2019 (GERMANY, SPAIN, SWITZERLAND) the issues of OS are not tacked explicitly, and offer very little in terms of defining what it means, or guidance on how to practice it.
5. It should also be noted that not all the categories were included in the Codes from FRANCE and AUSTRIA; citizen science is only addressed in the Austrian Code and open education in the French Code.
6. Seven of the Codes (± 37%) mentioned open publication (SPAIN, SWEDEN, NORWAY, SWITZERLAND, FRANCE, AUSTRIA, HUNGARY) mainly to underline their support to open access publication. However, only two of the Codes (SWEDEN and FRANCE) provided direct advice on the process of publishing and the availability of publications.
7. Approximately 53% of the Codes detailed the issues regarding data. However, only four Codes (SWEDEN (2017), AUSTRIA (2020), UK (2019) and GERMANY (2022)) explicitly mention open data and presented some recommendations on this issue. The other Codes that mentioned data management details (IRELAND (2019), SWEDEN, (2017), NETHERLANDS (2018), SPAIN (2021), LATVIA (2017) and HUNGARY (2010)) seem to reflect the tension regarding the recommendation “as open as possible, as closed as necessary”.
8. Six of the Codes (± 32%), explicitly support the reproducibility (SWEDEN, SWITZERLAND, AUSTRIA), reliability (SWITZERLAND, FRANCE, GERMANY), verifiability (SWITZERLAND), accuracy (SWITZERLAND), credibility (DENMARK) of science, though not by mentioning the openness of methods. The only exception is the Code from Denmark that explicitly mentioned Openness.
9. None of the Codes mention explicitly openness in the context of research evaluation methods. What the French Code does is to recognise as an openness-related issue the need for transparency on the recommendations for scientific evaluators “conclusions must be explained and justified” (FRANCE). Regarding Content Based Evaluation only four of the Codes mention this issue (SPAIN, FRANCE, GERMANY and AUSTRIA).

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10. Within the category of science communication, five of the Codes addressed the sub-category of “proactive and targeted societal outreach in some way: ITALY, NORWAY, DENMARK, FRANCE, AUSTRIA, the “scientific knowledge as universally understandable” is addressed in eight Codes; some make explicit references: (POLAND, SPAIN, BELGIUM, FRANCE, AUSTRIA) and some of them do not clearly tackle the requirement of being understandable (NETHERLANDS, DENMARK, FINLAND).

The ECoC defines action-oriented norms based on the values of: **Reliability**, **Honesty**, **Respect** and **Accountability**. Open science norms are expressions of the principles of **Transparency**, **Openness**, **Traceability**. However, both aim to increase the quality and trustworthiness of research.

In ethics, coined by Max Weber, value is characterized dichotomously as (1) intrinsic and (2) instrumental. An entity has intrinsic value if it is an end in itself and not merely or solely a means to another entity’s ends. The instrumental value of an entity is the value it has as a means to another entity’s ends, purposes, or goals[71]. In moral philosophy, instrumental and intrinsic value are the distinction between what is a means to an end and what is as an end in itself. Things are deemed to have instrumental value if they help one achieve a particular end; intrinsic values, by contrast, are understood to be desirable in and of themselves. Therefore, we may consider that openness (or transparency) are tools and, therefore have instrumental value because it helps research ecosystem to be in compliance with research integrity values-intrinsic values.

Therefore, and in line with the French and Austrian Codes, it is, in our opinion, desirable that both areas (RI and OS) are considered in an integrated manner. From the ALLEA code categories, it will not be difficult to recommend that in (1) Research procedures, open methods and tools may be included; (2) Data practices and management, open data may be considered; (3) Publication and dissemination may integrate the issues regarding open access and science communication; (4) Collaborative working, may include some norms on collaborative work and citizen science and the issues of open evaluation may be included in the ”Reviewing, evaluating and editing” (see Table 9).

[71] Callicott, J. B. (2012). Intrinsic and Instrumental Value. Obtido em 20 de 1 de 2023, de https://sciencedirect.com/science/article/pii/b9780123739322003665

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Table 9. Final proposal regarding open science matrix and suggestions on how integrate OS in RI Codes

Research cycle	Categorisation OS matrix category	Open science main value	Open science norms	Main impact in terms of RI principles	ALLEA context that may be considered
Conduct of research	Research Data	Openness Transparency	Access to and reuse of research data metadata	Reliability, Integrity Accountability and Respect	Data practices and management
Conduct of research	Research Methods/Tools	Openness Transparency	Access and re-use of research methods and research tools	Reliability, Integrity Accountability and Respect	Research procedures
Conduct of research	Research Evaluation	Openness Transparency	Transparency of research evaluations and peer review Content-based evaluation	Reliability, Integrity Accountability and Respect	Reviewing, evaluating and editing
Conduct of research	Research Collaboration	Openness Transparency	Access to research processes, infrastructure and tools and to the benefits of research Citizen Science	Reliability, Integrity Accountability and Respect	Collaborative working
Conduct of research	Education	Openness Transparency	Open Education	Reliability, Integrity Accountability and Respect	
Dissemination of research	Publication of Research	Openness Transparency	Access and re-use to/of research publications	Reliability, Integrity Accountability and Respect	Publication and dissemination
Dissemination of research	Science Communication	Openness Transparency	Scientific knowledge as universally understandable	Reliability, Integrity Accountability and Respect	Publication and dissemination

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APPENDICES

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APPENDIX 1

MAPPING THE EU28+ RESPONSIBLE RESEARCH NATIONAL CODES

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The complete listing of the 19 National Codes of Conduct which make the corpus of the study:

AUSTRIA

1. *Best Practice Guide for Research Integrity and Ethics*

https://oeawi.at/wp-content/uploads/2020/12/2020-10-20_Praxisleitfaden-fuer-Integritaet-und-Ethik-in-der-Wissenschaft_engl_.pdf
Austrian Federal Ministry of Education, Science and Research (BMBWF)
(2020)

BELGIUM

2. *Codes of Ethics for Scientific Research in Belgium*

https://www.kuleuven.be/english/research/integrity/practices/belspo-code
Académie Royale des Sciences, des Lettres et des Beaux Arts de Belgique; Koninklijke Vlaamse Academie van België voor Wetenschappen en Kunsten; Académie Royale de Médecine de Belgique; Koninklijke Academie voor Geneeskunde van België
(2009)

CZECH REPUBLIC

3. *Code of Ethics for Researchers of the Czech Academy of Sciences*

https://www.avcr.cz/en/about-us/legal-regulations/code-of-ethics-for-researchers-of-the-czech-academy-of-sciences/
The Czech Academy of Sciences
(2016)

DENMARK

4. *Danish Code of Conduct for Research Integrity*

https://ufm.dk/en/publications/2014/the-danish-code-of-conduct-for-research-integrity
Ministry of Higher Education and Science
(2014)

ESTONIA

5. *Estonian Code of Conduct for Research Integrity*

https://www.eetika.ee/sites/default/files/www_ut/hea_teadustava_eng_trukis.pdf
Centre for Ethics, University of Tartu; Estonian Research Council
(2017)

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FINLAND

6. *Responsible Conduct of Research and Procedures for Handling Allegations of Misconduct in Finland*

https://tenk.fi/sites/tenk.fi/files/HTK_ohje_2012.pdf
Finnish Advisory Board on Research Integrity TENK
(2012)

FRANCE[72]

7. *Integrity and Responsibility in Research Practices: Guide*

https://comite-ethique.cnrs.fr/wp-content/uploads/2020/09/COMETS-GUIDE-EN.pdf
CNRS Ethics Committee (COMETS)
(2017)

GERMANY

8. *Guidelines for Safeguarding Good Research Practice*

https://www.dfg.de/download/pdf/foerderung/rechtliche_rahmenbedingungen/gute_wissenschaftliche_praxis/kodex_gwp_en.pdf
German Research Foundation (DFG)
(2019) [revised version 1.1: 2022]

HUNGARY

9. *Science Ethics Code of the Hungarian Academy of Sciences*

https://mta.hu/data/dokumentumok/english/background/Science_Ethics_Code_English.pdf
Hungarian Academy of Sciences
(2010)

[72] In line with the article published by Desmond & DierickX (2021), the Integrity and Responsibility in Research Practice: Guide, from the CNRS Ethics Committee (COMETS) (2017), was chosen over the French Ethics and Scientific Integrity Charter, from the Agence Nationale de la Récherche, ANR (2019).

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IRELAND

10. *Policy Statement on Ensuring Research Integrity in Ireland*

https://www.iua.ie/wp-content/uploads/2021/04/National-Policy-Statement-on-Ensuring-Research-Integrity-in-Ireland.pdf
National Research Integrity Forum
(2019)

ITALY

11. *Guidelines for Research Integrity*

https://www.cnr.it/sites/default/files/public/media/doc_istituzionali/ethics/guidelines-for-research-integrity-2019.pdf
CNR Research Ethics and Integrity Committee
(2019)

LATVIA

12. *Code of Ethics for Scientists*

https://lzp.gov.lv/wp-content/uploads/2020/10/Etikas_kodekss_ENG.pdf
Latvian Academy of Sciences
(2017)

NETHERLANDS

13. *Netherlands Code of Conduct for Research Integrity*

https://www.nwo.nl/sites/nwo/files/documents/Netherlands%2BCode%2Bof%2BConduct%2Bfor%2BResearch%2BIntegrity_2018_UK.pdf
Royal Netherlands Academy of Arts and Sciences (KNAW); Netherlands Federation of University Medical Centres (NFU); Netherlands Organisation for Scientific Research (NWO); Associated Applied Research Institutes (TO2 federation); Netherlands Association of Universities of Applied Sciences; Association of Universities in the Netherlands (VSNU)
(2018)

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POLAND

14. *The Code of the National Science Centre on Research Integrity and Applying for Research Funding*

https://ncn.gov.pl/sites/default/files/pliki/Code-of-the-National-Science-Centre-on-Research-Integrity.pdf
National Science Centre
(2016)

SPAIN

15. *Code of Good Scientific Practices of CSIC*

https://www.csic.es/sites/www.csic.es/files/cbpc_csic2021.pdf
Spanish National Research Council
(2021)

SWEDEN

16. *Good Research Practice*

https://www.vr.se/download/18.5639980c162791bbfe697882/1555334908942/Good-Research-Practice_VR_2017.pdf
Swedish Research Council
(2017)

NORWAY

17. *General Guidelines for Research Ethics*

https://www.forskningsetikk.no/en/guidelines/general-guidelines/
Norwegian National Research Ethics Committees
(2014)

UNITED KINGDOM

18. *The Concordat to Support Research Integrity*

https://www.universitiesuk.ac.uk/sites/default/files/field/downloads/2021-08/Updated%20FINAL-the-concordat-to-support-research-integrity.pdf
Department for the Economy, Northern Ireland; Higher Education Funding Council for Wales; National Institute for Health Research; Scottish Funding Council; UK Research and Innovation; Universities UK; Wellcome Trust; The British Academy;Cancer Research UK; GuildHE Research
(2019)

SWITZERLAND

19. *Code of Conduct for Scientific Integrity*

https://api.swiss-academies.ch/site/assets/files/25607/kodex_layout_en_web-1.pdf
Swiss Academies of Arts and Sciences
(2021)

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APPENDIX 2

THE SELECTED EXCERPTS SUPPORTING THE MARKS OF THE CONTENT ANALYSIS IN PRETEST 1

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For Table 1. Austrian Code [DOC 1], 2020.

“Transparency means ensuring that it is clear what data, materials, and methods the research was based on and how the results were achieved. The line of reasoning must be clear, and the individual steps in the research process must be verifiable.” [s1]

“Fairness towards other researchers is especially important in the review processes and in the investigation of research misconduct.” [s2]

“The researchers should ensure that sources are verifiable and research data and materials used and collected are described as precisely and clearly as possible.” [s3]

“The presentation of the sources, materials, data, and arguments should be precise and scrupulous. The methods used and the respective steps of the entire research process must be clear. The manner in which the outcome was achieved and its interpretation should be presented in a transparent way. As a rule, the results and the manner in which they were achieved are to be described in as much detail as possible to make the collection and analysis of the research data and materials reproducible. This means, for instance, that researchers explicitly disclose all relevant research data and materials—in particular, those that could possibly lead to other conclusions (see Section 4.1).” [s4]

“References to the research data and materials should be included in the publication so they can be used for any meta-analyses.” [s5]

“With regard to the publication and dissemination of research results, research institutions should ensure that contracts with the clients and funding organisations contain fair agreements about the rights, access, publication, and reuse of data and research materials and that the research results are disseminated to a broad public in a scrupulous way (see Sections 4.2 and 4.5).” [s6]

“The most common types of violations, which must always be dealt with on a case-by-case basis, include:

[…]
• the unjustified refusal to provide access to primary and original data including information on how such data was obtained, or the disposal of such data before the applicable retention periods have passed; […]” [s7]

“Precise documentation of a high-quality study design ensures the reproducibility and thus the credibility of research results.” [s8]

"Research data management is particularly important for quality assurance. [s9]

“Following the completion of a study, the research data and materials should be safeguarded in a way that prevents subsequent manipulation. In addition, it should be ensured that the original data are still available in a machine-readable format, whenever possible, even after an extended period of time. [s10] As part of this storage, the corresponding metadata should also be archived in a sustainable and accessible manner.” [s11]

“It is recommended that the institutions provide the appropriate infrastructure to ensure good data management. Such data management allows for the permanent storage and management of research data and materials and the corresponding metadata, regardless of whether these are published or not. The Austrian Agency for Research Integrity recommends ten years as an appropriate retention period. It should also be ensured that the data are accessible in accordance with the FAIR Principles (Findable, Accessible, Interoperable, Re-usable) and the necessary confidentiality is maintained. The research institutions should provide information on the form in which the research data and materials must be available (see for this the next section on Open Science).” [s12]

“Researchers and research institutions should act in accordance with the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities and create the conditions to enable open access [s13] to research publications and research results [s14] on the internet. A further aim should be to provide open access to the entire research cycle as far as possible. [s15] This new form of research practice known as international Open Science or Open Research should make research results more reproducible and available to a broad audience. The fundamental principle and aim of Open Science is to provide open access to scientific and scholarly research results.” [s16]

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“The publications (including the underlying research data and materials as well as the corresponding metadata) in the form of journal articles, monographs, anthologies, proceedings, or similar publications are made available on a permanent and open basis under an open license for easy reuse.” [s17]

In addition to publications, research data and materials including the corresponding metadata are a key component in the verifiability and reproducibility of research results (see Section 4.1). Research data and materials should, at the very least, always be made freely accessible when they serve as the basis of scholarly publications and there are not any legal, ethical, or other documented reasons preventing their availability. This means that according to the FAIR Principles they must, for instance, be made open access simultaneously with the publishing of the publication; be archived in a registered repository; be able to be reused without restrictions; and be citable by a persistent identifier.” [s18]

“In the exercise of their responsibility, researchers proceed with assessments in an honest, transparent, and scrupulous manner; review only the areas within their scholarly expertise; and provide detailed reasons for the outcome of their assessment.” [s19]

“In general, the assessment of research performance should focus primarily on the quality of the research. If non-research related factors are used, these must be explained and be made transparent.” [s20]

“A substantial portion of the research in Austria is funded by the public sector. For this reason, among others, it is recommended to involve the non-scientific public in an open and transparent manner. Such involvement is also important because research results can have a wide range of implications for society and each individual.” [s21]

“Furthermore, the stronger involvement of relevant stakeholders and interested laypeople as well as patient groups can contribute to improving scientific knowledge.” [s22]

“Another important argument for more interaction between researchers and the public is that disinformation is growing in influence due to social media. It is therefore the responsibility of researchers to counter this false information with their scholarly expertise.” [s23]

“Science communication is an instrument suited for achieving these goals. This includes, in particular, the generally understandable communication of complex scientific content for an interested non-scientific audience. Researchers and research institutions should be encouraged to use different channels to address as wide a public as possible and raise their interest in science and research while at the same time being open to feedback from this same public.” [s24]

“Other ways of involving the non-scientific public are participatory approaches, such as citizen science, citizens’ conferences, or participatory technology assessment, which are characterised by the active inclusion of practical knowledge and/or interested citizens in the carrying out of research projects. Citizen science or other similar transdisciplinary approaches should be used especially in situations where they are a suitable method for answering research questions. In addition, efforts can be made to find new approaches for involving the public in research funding in an appropriate manner. Ideally, this would not only make science and research more transparent but also more understandable. This, in turn, helps the public to make connections between science and research and their lives.” [s25]

“To prevent the undesired use or misuse of research findings, research institutions should encourage both institutional as well as individual reflection on such risks. The potential risk posed by misuse and dual use can be minimised through a variety of means. These include:

• technical and organisational measures (e.g., access restrictions or permissions);
• inclusion of external expertise (e.g., consultation with the advisory body established by the institution);
• adaptation of the research design (e.g., the selection of organisms that are classified as well researched and as largely safe);
• voluntary research restrictions such as refraining from publication, appropriate editing of the publication (communication only with a limited group of people), or a voluntary moratorium on research as a last resort.” [s26]

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For Table 2. French Code [DOC 7], 2017.

“Data production procedures must be described in clear and explicit terms so they can be replicated by other researchers and re-used.” [s1]

“In some disciplines—particularly in experimental research—traceability is ensured by a laboratory notebook, which may be a key part of quality assurance in research settings.” [s2]

“Archiving, traceability of raw data and the use of an unforgeable laboratory notebook are the only legal ways to prove the prior existence of results in the context of a contract, a patent application or a dispute.” [s3]

“It is a major piece of evidence that can be used in the event of a conflict or allegation of fraud.” [s4]

“The DOI allows individuals to access, share, re-use and cite online resources, research data and publications. It also ensures long-term access to scientific materials such as images and videos. Its use is therefore recommended.” [s5]

“Examples of inappropriate data management practices

• Denying data access to colleagues. [s6]
[…]
• Interfering with or obstructing other researchers' work, especially by making data, research material or equipment unavailable or unusable. [s7]
[…]”

“Research is increasingly reliant on the use of ‘big data’, a term that generally refers to an aggregation of data acquired by teams located all over the world who agree to data sharing, i.e. making their data available to all. Data from research financed through public funding must be made freely available, which is the very principle of open data. Indeed, this is stated in the French Research Code (Art.L.112-1) and forms part of the objectives of both the European Horizon 2020 programme, and the French Digital Republic Act of 201613, which makes access to scientific data mandatory (Art. 9)” [s8]

“Four international organisations have signed the "Open data in a big data world" agreement15, which lays down the basic principles to be adopted when using open data, along with recommendations on how to combine scientific rigour and ethics. However, these principles are not fully compatible with those of France’s National Commission for Information Technology and Civil Liberties (CNIL) in the case of personal data.” [s9]

“Researchers are ethically obliged to make their research findings available to both the scientific community and the public. Those who receive public funding are legally obliged to do so.” [s10]

“**Publication** means any act that makes research findings public through journals, conference proceedings, open archives, blogs, websites, tweets, etc.” [s11]

“Guidelines for the preparation of manuscripts

[…]
• Experimental protocols must be sufficiently well documented and open to allow other teams to reproduce them. [s12]
• Raw data must be accessible insofar as the discipline allows. [s13]
[…]”

“**Open access** refers to the free online availability of original results of scientific research. The right to open access is enshrined in the French Digital Republic Act, which stipulates that publications must be available to the public after an embargo of 6 months maximum (12 months for Social and Human Sciences) following their acceptance by the publisher.” [s14]

“Open access to publications resulting from research funded even partially by the European Horizon 2020 programme is obligatory.
Open-access journals allow articles to be immediately available on the internet. The authors and/or institutions assume the cost of publication in the form of an Article Processing Charge (APC). Authors should remain vigilant

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in view of the proliferation of second-rate online journals created by 'predatory publishers'. Open-access journals subject to a peer review are listed in the Directory of Open Access Journals (DOAJ)22. Articles published in traditional journals may become open-access after the legally-defined embargo period." [s15]

Some scientific social networks (such as Academia, ResearchGate or MyScienceWork) are designed to facilitate communication between researchers and give their work visibility. Researchers can not only notify their publications on these networks but also deposit them on the website, which must be used in accordance with rules of good conduct. […] Importantly, by uploading the publication to these websites, the author hands over all rights concerning it. Any publication thus deposited becomes the exclusive property of the network, which is then free to exploit it as it likes, particularly for commercial purposes [s16].

"Researchers must make their knowledge and research activities available to the public, so that nonexperts can understand the evidence and advantages." [s17]

"Transferring copyright to a publisher may prevent the automatic re-use of the researcher's work in other formats or in future compilations. It often takes away the author's right to re-use parts of the text submitted. Authors are strongly advised to carefully read the contract and discuss clauses in detail with the publisher. They are also advised to use Creative Commons (CC) licenses, which allow copyright holders to keep their rights while making their work publicly available under predefined conditions." [s18]

"• The published images and illustrations can be re-used in keeping with the conditions indicated in the contract with the publisher." [s19]

"• Publishers can re-use parts of an article in another context if the property rights have been reassigned to them and if such re-use is mentioned in the contract." [s20]

"• Depositing a text in an open archive counts as publication." [s21]

"The re-use of materials for teaching or research purposes is permitted within the scope of the educational exception."[s37]

"Some recommendations for scientific evaluators

• Transparency. [s22]
  o Their conclusions must be explained and justified so that they can be defended in the event of an appeal.
  o Those researchers concerned must have access to the elements upon which the evaluation is based.
  o If valid objections are raised, evaluators cannot refuse to participate in the subsequent investigations."

"In the light of the frequent inappropriate use of bibliometric indicators when evaluating research, publishers of scientific journals, academies and institutions all over the world published in 2013 the "San Francisco Declaration on Research Assessment" (DORA), which calls on evaluators not to use the IF to evaluate researchers' activity. The Leiden Manifesto33 has set out general principles that should enable a better use of bibliometric indicators when evaluating research." [s23]

"10 principles for a judicious evaluation using bibliometric indicators

• Quantitative evaluation should support qualitative, expert assessment. [s24]
[…]
• Keep data collection and analytical processes open, transparent and simple. [s25]
[…]
• Base assessment of individual researchers on a qualitative judgement of their portfolio. [s26]
[…]
• Recognise the systemic effects of assessment and indicators. [s27]
• Scrutinise indicators regularly and update them [s28]."

"Researchers today therefore have a strong responsibility to the scientific fields in which they have chosen to work.
It is also important to emphasise researchers' responsibility to society. One of the aims of science is indubitably to contribute to the common good of humankind. Yet the relationship between science and society has altered

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profoundly over the course of history. The advances in technology that result from scientific discoveries cannot generally be foreseen. Today, the notion of progress has been called into question due to growing awareness of the impact of technologies on the environment and human health. Researchers and research institutions cannot avoid the scientific questions that citizens are asking, and need to use their knowledge to shed light on such issues." [s29]

"There is an urgent need to consolidate the relationship of trust between scientists and citizens. In a world shaken by successive crises and controversies on sensitive matters, researchers have to listen to the public's questions on the impact of their research. Now that the public has become aware of new types of risk, public opinion has become increasingly divided between admiration for the meteoric progress of science and worry over some of its applications. Moreover, the complexity of phenomena means that unequivocal answers to scientific controversies are not always possible. Without denying the autonomy of the scientific world, and as recalled by UNESCO's 1974 Recommendation on the Status of Scientific Researchers, updated in 2016, researchers should give serious thought to the responsibility that frames their intrinsic liberty." [s30]

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For Table 3. Danish Code [DOC 4], 2014.

"Honesty, transparency, and accountability should pervade all phases of the research process, as failure to respect these basic principles jeopardises the integrity of research to an extent that may threaten the freedom of research." [s1]

"To ensure the credibility of scientific reasoning and to ensure that academic reflection is consistent with practice in the relevant field of research, all phases of research should be **transparent**.
This requires openness when reporting:

• conflicts of interest
• planning of research
• research methods applied
• results and conclusions" [s2]

"ii. Research should be documented in a manner consistent with practices in the field of research in question, e.g. by keeping records, logbooks, journals or similar practices – if possible with dates and entries by the person(s) responsible for the conduct of the research. To the extent possible, the documentation should allow the research to be examined and – when relevant – reproduced." [s3]

"**Researchers** should not enter into agreements (e.g. with funders or others) that limit their access to their own data and their ability to analyse and publish these data independently, unless such access limitations can be justified by the specific circumstances." [s4].

"Responsible conduct of research includes proper management of primary materials and data.
The key purpose of data management is to guarantee credible and transparent research." [s5].

"i. Primary materials and data should be retained, stored and managed in a clear and accurate form that allows the result to be assessed, the procedures to be retraced and – when relevant and applicable – the research to be reproduced. The extent to which primary materials and data are retained and the recommended retaining period should always be determined by the current practices applicable to the specific field of research. However, data should in general be kept for a period of at least five years from the date of publication." [s6]

"ii. The data records should enable identification of persons having conducted the research and persons or institutions with responsibility for the primary materials, data, and research results. The data records should contain a precise and traceable reference to the source. Any changes to the primary materials or data stored should be clearly accounted for in a way that allows clear identification of the changes made." [s7]

"iii. **Institutions** should maintain a policy on the retention of primary materials and data that includes information on:

a. Storage of primary materials and data
b. Secure and safe disposal of primary materials and data after the retention period
c. Responsibility for and access to primary materials and data
d. Data retention, accessibility and ownership when researchers leave the institution

iv. **Institutions** are responsible for providing secure data storage facilities that are consistent with confidentiality requirements and applicable regulations and guidelines, e.g. on the processing of personal data.
v. Institutions should allow access to the stored primary materials and data, except when this is in conflict with contractual legal obligations or current regulations on for example ethical, confidentiality or privacy matters or intellectual property rights." [s8]

"Research can be communicated through various channels ranging from strictly professional contexts aimed at peers to more popular research communication aimed at a broader audience. Although form, expression and level of detail may differ according to channels employed and audiences addressed, the standards for responsible conduct of research should always be respected when communicating research." [s9]

"iv **Researchers acting as peer reviewers and editors** should carry out their review and editorial obligations in an honest and unbiased manner." [s10]

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“Institutions should promote and maintain an environment that supports honesty, transparency, and accuracy when disseminating research findings, e.g. through policies and training relating to publication and communication.” [s11]

“i. All collaborating partners should – to the extent possible – take responsibility for the integrity of the collaborative research.
ii. Collaborating partners should – if feasible and preferably as early as possible in the research process – establish agreements on all relevant areas, and specify how responsible conduct of research will be applied throughout the collaborative research.2
iii. Where appropriate, common agreements should – in addition to standard agreements on the practical implementation of the research – be established on the following:

a. Intellectual property rights b. Procedures for addressing conflicting laws, regulations, practices, etc. c. Procedures for resolution of conflicts between collaborating partners d. Publication issues e. Use, sharing, ownership and management of data f. Confidentiality g. Conflicts of interest h. Procedures for reporting and handling breaches of responsible conduct of research, including research misconduct” [s13]

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For Table 4. Belgian Code [DOC 2], 2009.

“This “Code of Ethics for Scientific Research in Belgium” establishes the major principles of ethically justified scientific practice. The code of ethics presented hereafter stipulates that researchers must carry out their research in a rigorous manner and that they must faithfully publish the relevant information by describing the methods and the results in such a way that they can be verified. [s1] A code of ethics does not only contribute to the quality of the scientific research, but also to its legitimation: it demonstrates to citizens, who finance the majority of research and reap the benefits, that the world of research is developing its own tools to guarantee responsible research.” [s2]

“Neither the pressure to transpose the research results as quickly as possible to exploitable applications, nor the concern to protect the results justifies constraints to ethical behaviour when carrying out research.” [s3]

“In media communications or presentations, the researcher must present his/her research results in a truthful and comprehensible way. He/she must avoid arousing unjustified fears or hopes.” [s4]

“Researchers’ work is deemed to be verifiable when it allows colleagues to follow the progress of the research and to reproduce it, if need be.” [s5]

“The information given should be verifiable. The results of the literature study, the hypotheses, the organisation of the research, the research and analysis methods, as well as the sources, are described in detail (in a research logbook, a laboratory diary or a progress report) so that other researchers can verify the accuracy of the process and reproduce it.” [s6]

“The primary data of a research project and the protocols must be kept and made accessible during a determined and sufficient period of time. When publications, especially review and summary articles, do not contain all the necessary data for verification, the data should nevertheless be available.” [s7]

“By participating in peer review, the researcher should only be guided by considerations of a scientific order. The confidentiality of the information should be guaranteed. The assessment of manuscripts for scientific journals must be carried out in an impartial manner and within a reasonable deadline.” [s8]

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APPENDIX 3

LIST OF IDENTIFIED REFERENCES FOR EACH CATEGORY OF OPEN SCIENCE IN THE RESPONSIBLE RESEARCH NATIONAL CODES

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OPEN ACCESS

LIST OF IDENTIFIED REFERENCES

– REUSE OF RESEARCH PUBLICATIONS

FRANCE

V “The DOI allows individuals to access, share, re-use and cite online resources, research data and publications. It also ensures long-term access to scientific materials such as images and videos. Its use is therefore recommended.”

V “Some scientific social networks (such as Academia, ResearchGate or MyScienceWork) are designed to facilitate communication between researchers and give their work visibility. Researchers can not only notify their publications on these networks but also deposit them on the website, which must be used in accordance with rules of good conduct24. Researchers are individually responsible for the work they deposit, and not the employing institution, even if its name is mentioned. Importantly, by uploading the publication to these websites, the author hands over all rights concerning it. Any publication thus deposited becomes the exclusive property of the network, which is then free to exploit it as it likes, particularly for commercial purposes.”

V “Transferring copyright to a publisher may prevent the automatic re-use of the researcher’s work in other formats or in future compilations. It often takes away the author's right to re-use parts of the text submitted. Authors are strongly advised to carefully read the contract and discuss clauses in detail with the publisher. They are also advised to use Creative Commons (CC) licences, which allow copyright holders to keep their rights while making their work publicly available under predefined conditions.”

V “The published images and illustrations can be re-used in keeping with the conditions indicated in the contract with the publisher.”

V “Publishers can re-use parts of an article in another context if the property rights have been reassigned to them and if such re-use is mentioned in the contract. Researchers can not only notify their publications on these networks but also deposit them on the website, which must be used in accordance with rules of good conduct24. Researchers are individually responsible for the work they deposit, and not the employing institution, even if its name is mentioned. Importantly, by uploading the publication to these websites, the author hands over all rights concerning it. Any publication thus deposited becomes the exclusive property of the network, which is then free to exploit it as it likes, particularly for commercial purposes.”

AUSTRIA

V “The publications (including the underlying research data and materials as well as the corresponding metadata) in the form of journal articles, monographs, anthologies, proceedings, or similar publications are made available on a permanent and open basis under an open license for easy reuse.”

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– ACCESS TO RESEARCH PUBLICATIONS

SPAIN

V "The CSIC promotes and supports open-access publication and accessibility to its scientific production in repositories and, in particular, in the Institutional repositories."

V "In order to consolidate the institutional commitment to open science, the CSIC promotes publication in open-access journals and/or repositories and encourages the sharing of data, codes and materials within the scientific community".

SWEDEN

V "The importance of other researchers being able to verify the results naturally also applies to publication, including the increasingly common requirement of open access…"

V "Open access to scientific publications has a number of advantages. For researchers, it is an excellent way of rapidly presenting their findings, and making their texts easily accessible. This makes work available to researchers, whose departments cannot afford to subscribe to scientific journals, and to students and teachers who can use them freely for educational purposes. The more readers a text has, the greater the chance is that it will be of benefit. The OECD, the European Commission and other organisations have stressed that scientific work financed by public funds should also be openly accessible to all. The disadvantage, to the individual author, of the additional costs of making a research article openly accessible must be weighed against the advantage of avoiding expensive subscription fees."

V "The signatories Berlin Declaration on open access to scientific knowledge intend to encourage researchers to publish their results on the Internet, to develop methods for safeguarding the quality of online publication, and to work towards open publication being counted as a merit in the evaluation and recruitment of researchers."

V "Since 2010, researchers granted funding from the Swedish Research Council are obliged to publish their results according to the principle of open access (open access journal, hybrid or self-archiving; the concepts are explained in the next section). Research articles lodged shall be made openly accessible within six months. For researchers with grants within educational sciences or humanities and social sciences, open access has to be made available within twelve months. The Swedish Research Council's rules concerning open access currently only apply to scientifically reviewed texts in journals and conference reports, and not monographs or book chapters. Journals often publish material electronically, but it is important to remember that this does not automatically entail that it becomes openly accessible.

In order to publish according to the requirements for open access, there are three options: (1) in an open-access journal – these, just like traditional scientific journals, use peer review to assess the quality of the research articles; (2) Hybrid publication – the research article is published in a subscription-based journal, which offers the author the choice of open access, against a fee; (3) Self archiving – which means that the researcher, in addition to publishing the research article in a subscription based scientific journal, also deposits it at the time of publication in an open repository, and is made openly accessible within six or twelve months."

V "The legal room surrounding self-archiving is dependent on the policy of the journal/publisher. To help researchers in handling rights issues, the EU Commission's framework programme for research and innovation, Horizon 2020, has produced an appendix to the publication agreement. This appendix guarantees that the researcher retains the right to deposit the work in an open archive, and thus make it freely accessible. An accompanying letter that researchers can use in their contacts with publishers has also been produced, see the website sparcopen.org Despite this, self-archiving is regarded as complicated, and for this reason the major journal publishers are offering the option of hybrid publication, which replaces the need for an appendix to the publication agreement and avoids the risk of several different versions of the work being published. Developments in technology have entailed a fundamental change within the area of scientific publication".

NORWAY

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V “As a main rule, research results should be made available. Openness regarding research findings is essential for ensuring verifiability, for returning some benefit to the research participants and society in general, and for ensuring a dialogue with the public. Such communication is also a function of democracy”.

SWITZERLAND

V “Unless otherwise agreed, scientists should commit to making their work available to a wide audience as soon as possible in accordance with the Open Science principle.”

FRANCE

V “Researchers are ethically obliged to make their research findings available to both the scientific community and the public. Those who receive public funding are legally obliged to do so.”

V “Publication means any act that makes research findings public through journals, conference proceedings, open archives, blogs, websites, tweets, etc.”

V “Open access refers to the free online availability of original results of scientific research. The right to open access is enshrined in the French Digital Republic Act, which stipulates that publications must be available to the public after an embargo of 6 months maximum (12 months for Social and Human Sciences) following their acceptance by the publisher. Open access to publications resulting from research funded even partially by the European Horizon 2020 programme is obligatory.

Open-access journals allow articles to be immediately available on the internet. The authors and/or institutions assume the cost of publication in the form of an Article Processing Charge (APC). Authors should remain vigilant in view of the proliferation of second-rate online journals created by ‘predatory publishers’. Open-access journals subject to a peer review are listed in the Directory of Open Access Journals (DOAJ)22.

Articles published in traditional journals 23 may become open-access after the legally-defined embargo period.

Multidisciplinary repository platforms such as ArXiv, HAL (Hyper Articles en Ligne) and bioRxiv allow researchers to deposit articles and various manuscripts online (including theses, conference papers or review articles as a preprint or final version). It is strongly recommended to publish PhD theses on HAL, as the platform provides an archiving and indexing system that is particularly useful for the career development of young doctorates or researchers. HAL also fulfils the requirements of the Horizon 2020 programme”.

V “Some scientific social networks (such as Academia, ResearchGate or MyScienceWork) are designed to facilitate communication between researchers and give their work visibility. Researchers can not only notify their publications on these networks but also deposit them on the website, which must be used in accordance with rules of good conduct24. Researchers are individually responsible for the work they deposit, and not the employing institution, even if its name is mentioned. Importantly, by uploading the publication to these websites, the author hands over all rights concerning it. Any publication thus deposited becomes the exclusive property of the network, which is then free to exploit it as it likes, particularly for commercial purposes”.

V “Depositing articles in open archives

• Depositing a text in an open archive counts as publication.

• Depositing the full text of an article in an open archive requires the co-authors' agreement.

• Authors can manage the rights pertaining to their own work by using a Creative Commons licence.

• The full text of a published article can be made available on a personal website if so permitted by the contract with the publisher. It may also be deposited in HAL”.

AUSTRIA

V “Researchers and research institutions should act in accordance with the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities and create the conditions to enable open access to research publications and research results on the internet. A further aim should be to provide open access to the entire

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research cycle as far as possible. This new form of research practice known as international Open Science or Open Research should make research results more reproducible and available to a broad audience. The fundamental principle and aim of Open Science is to provide open access to scientific and scholarly research results."

V "The publications (including the underlying research data and materials as well as the corresponding metadata) in the form of journal articles, monographs, anthologies, proceedings, or similar publications are made available on a permanent and open basis under an open license for easy reuse."

HUNGARY

(V) "...openness is one of the ethical fundamental principles of scientific research, according to which the development of science is based on the open communication and debate among scientists. Should scientists seclude themselves from such communication, being afraid of not being recognised as discoverers, this will spoil even the science itself."

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OPEN DATA

LIST OF IDENTIFIED REFERENCES

– ACCESS TO AND REUSE OF RESEARCH DATA METADATA AND/OR RESEARCH DATA

IRELAND

(V) “Research data is a valuable resource that should be organised, curated and appropriately stored. As used here, the term ‘research data’ generally encompasses the methodology used to obtain results, the actual research results and the analysis and interpretations by the researchers. Primary responsibility for observing good practice in the use, storage, retention and preservation of data sits with the individual researcher, supported by the institution, and should follow the principles below, which are in line with the “National Framework on the Transition to an Open Research Environment” [11] and the “European Code”:

V “Research data should be stored in secure and accessible form and must be retained for a length of time in accordance with national, institutional, funder and/or publisher requirements.”

V “Research data and records may be discoverable in the event of legal proceedings. This means that the research data and records can be accessed by the higher education institution (or other research performing institution) and its legal advisers, to determine their relevance to any legal proceeding.”

V “The “National Framework on the Transition to an Open Research Environment” underlines the importance of making research data “as open as possible, as restricted as necessary”. Open access to research data should lead to greater integrity in the gathering, analysis and presentation of data as it may be open to scrutiny by peers, globally. It should also facilitate reuse of data for further research, contribute to public knowledge and inform policy and practice.“

(V) “Data access arrangements should take into account the applicability of data protection and intellectual property regulations. Clear governance and protocols should be developed on how such sensitive data may be accessed.”

V “The “National Framework on the Transition to an Open Research Environment” guides the development of Open Research policies in Ireland. Each principle outlines the responsibility of different stakeholders. The principles underline the importance of management of research data across all stages of the research process and recommend the use of Data Management Plans by researchers and research teams. They also recommend adoption of the FAIR (Findable, Accessible, Interoperable and Reusable) [12] data principles in Ireland”.

V “Proposals developed to enable Ireland to deliver on the EU Open Science agenda and to meet our EU objectives need to be achievable, sustainable, and appropriately resourced where necessary to facilitate research institutions and organisations in supporting the proper management and protection of data and research materials in all their forms (encompassing qualitative and quantitative data, protocols, processes, other research artefacts and associated metadata). Experience in Europe recommends that this be considered as a serious national investment in infrastructure and people within long-term budgetary cycles”.

V “Data-related misconduct, for example: – Not preserving primary data where appropriate – Bad data management, storage – Withholding data from the scientific community”.

V “Define procedures and roles and assign duties for the processing and storage of material and data: researchers identify and formally appoint individuals in charge of the use, management and storage of material and data produced by the research. Similarly, the roles of the individual participants are established, as well as any access to data by third parties. Measures, tools and methods for the optimal conservation of raw data are specified.”

V “Assign responsibilities and procedures for data processing: the person in charge of data processing at the research institute where the project is being conducted formally designates one or more per son(s) authorised to

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process any personal data collected in the course of the research activities. These authorised persons should preferably include the Principal Investigator. The authorised persons communicate to the person in charge of data processing: the type of data to be collected; the project aims in relation to the data processing; the legal basis for processing; the regulations regarding processing that have been provided to the interested parties; who amongst the project staff will have access to the data; what safety measures (structural, technical and organisational) for data processing and storage have been put in place; the results of preliminary evaluations of the impact of data processing on the rights of the interested parties, as required by current regulations; and all relevant information for the updating of the Register for personal data processing of the research institute".

V "Store material and primary data: the evaluation of the project's soundness and of the importance and authenticity of its results may require, post-publication, the analysis of raw data, registers, material and information relating to the research itself. Therefore, the following elements should be stored in an accessible form for 5 years, or 10 years if they are in electronic form."

V "Any requests to access this material by those authorised to it must be granted promptly and unreservedly. Moreover, researchers must promptly report the loss or theft of material and raw data to the appropriate offices of their institute and, if required by specific agreements or publication rules, to the editors-in-chief of the journals in which the research was published".

V "Respect data protection regulations: patients and, more generally, people recruited in research, are safeguarded in terms of the protection of their personal data. Such data is only to be published anonymously, in compliance with specific regulations regarding their processing. Those authorised to process personal data shall render themselves available to those whose data has been collected so as to allow them to concretely exercise their rights. They must also make sure that the safety measures for data processing are followed properly – including limitations to their access and their storage format – and immediately inform the person in charge of data processing at the research institute in case of a breach of those measures. On the basis of the information provided by the people authorised to conduct data processing, the person in charge of processing will update the personal data processing Register of the research institute. "

V "declaring the false possession, particularly in publications, of original data and material; destroying data, registries and information relating to research before the deadline established by the institution of affiliation;"

V "impeding access to material, data, registries, and information before the deadline specified as the minimum time limit for their retention, in response to a request for verification by an authorised third party."

NETHERLANDS

(V) "Transparency means, among other things, ensuring that it is clear to others what data the research was based on, how the data were obtained, what and how results were achieved and what role was played by external,"

(V) "Manage the collected data carefully and store both the raw and processed versions for a period appropriate for the discipline and methodology at issue."

(V) "Always provide references when reusing research material that can be used for meta-analysis or the analysis of pooled data."

V "Ensure that, as far as possible, data, software codes, protocols, research material and corresponding metadata can be stored permanently."

V "Ensure that all data, software codes and research materials, published or unpublished, are managed and securely stored for the period appropriate to the discipline(s) and methodology concerned".

V "Ensure that it is clear how data, software codes and research material can be accessed."

V "Ensure that contracts with commissioning parties and funding bodies include fair agreements about access to and the publication of data and research material."

POLAND

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(V) “Responsible conduct of research includes appropriate management of the primary materials and data.” Primary material is any material (e.g. biological material data bases, notes, records, images, literature, digital raw data) that forms the basis of the research.”

(V) “Primary materials and data should be retained and stored in an accurate form that allows the result to be assessed, the procedures to be retracted and, when relevant and applicable – the research to be reproduced. Primary materials and data must be documented in a manner that allows identification of the researcher or the research institution in charge of collecting the primary material and data, and for the analysis of the final results”.

The data records should contain a precise and traceable reference to the source of the primary materials. Any changes to the primary materials or data stored should be clearly accounted for in a way that allows clear identification of the changes made12. “In the procedure concerning the charge of the infringement of research integrity rules, the lack of such data is treated as an incriminating circumstance”“.

V “For the duration of the research, researchers should prepare a plan of data management and protection and make it available at Centre's potential request. The information must pertain, in particular, to the type of results to be obtained in the project, manners of their protection, period of retention and protection, as well as the period of availability to other researchers.”

(V) “Every project which assumes the development of data bases or collections with potentially long-term value should have in place a plan of results management and disclosure. This applies in particular to the research that may constitute the so-called social resource, pursuant to the definition included in the Declaration of Toronto of 2009 on the release of primary data that may accelerate the advancement of science. This group includes, without limitation, the results of large-scale research, cost-intensive research and results of broad utility or constituting primary material for further research” .

V “Researchers are responsible for retaining primary materials and data for the period specified above. They should consider the scientific value of the material in the context of assessing the research results and ensure the conditions for storage of the material at the institution. “

V “The research institution should have in place a policy on the retention of primary materials and data. The policy must include information on the methods of archiving, safeguarding and safe forms of disposal or utilisation of materials after the required retention period; the storage, availability of archived materials, right to keep the primary materials and results in the institution when the researcher responsible for obtaining the results changes their place of employment. Furthermore, the institution must protect archived materials against damage and unauthorised access, in compliance with the regulation on the protection of personal data, with specific emphasis on the protection of sensitive data.”.

V “Pursuant to the rule of professional kindness, a research institution should, at researchers' request, allow access to the stored primary materials and results available to them…”

V “Researchers are responsible for publishing and communicating their research25. The decisions about such activities are made by the principal investigator. Following publication of the results, the collected data and unique material analysed in the research should be made immediately and fully available to researchers looking for relevant information. Exceptions are made in situations where data confidentiality (e.g. personal data) must be ensured or the collected unique material was obtained under an agreement that prevents dissemination”.

SPAIN

V “In scientific research, the data recorded from experiments and observations, as well as the materials and equipment used are the basis of the results and of any publications or patents. Therefore, the fundamentals of research design and interpretation need to be understandable and, where feasible, experiments should be reproducible. This implies that the experimental protocols and the original data must be retained by the researcher, the research group and the institution, for a period of time…”

V “The ownership of the information generated corresponds to the Institution in which the work has been carried out and the latter must provide the personnel conducting the research with sufficient material means and adequate supports to store the data obtained.”

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V “With regard to personal data, and to guarantee fair and transparent processing of the same, those subjects involved in the research must be informed of the specific purposes and legal basis of the process for which their data is intended, the recipients, duration and conservation criteria, as well as of the rights to which they are entitled.”

(V) “Deposit the materials, data and originals of the protocols generated during their scientific activity in the assigned laboratory.”

V “The Institution and the research staff must ensure the proper conservation and management of all knowledge and materials generated in the research processes – including those unpublished – ensuring their protection and adequate access to them for a reasonable time period. In particular, where the information constitutes non-repeatable documentation, it must be kept permanently and securely and made available to other researchers. Data management should in any case facilitate search, accessibility, interoperability and reuse for”.

SWEDEN

(V) “If it is a case of sensitive personal data, more comprehensive and considered protective measures are needed.”

(V) “As just discussed, a researcher cannot promise that no one outside the research group will ever have access to the material or information collected in the course of the study. There are many situations in which access to research material is justified and necessary. For example, it could be a case of other researchers wanting to test the strength of scientific results, an opponent at a disputation requesting access to the basic data, or a report of suspected research misconduct, clinical trials (e.g. inspection), a court ruling or an ongoing court case. It also cannot be ruled out that research material may be handed over to other researchers in cases besides”.

(V) “Documentation Data collected for a research project is called source data. Sometimes, researchers consider source data to be their own individual property. This might possibly be the case if the research is privately funded and conducted by individuals not associated with normal research environments, and the data does not include personal data. But when the research is conducted at a university or other research institution, or when it is funded with public funds through grants from a research council or foundation, it is the organisation where the research is conducted that owns the material. The researcher or research group can thus not do whatever they want with it, for instance take it with them upon changing jobs, without agreements and special arrangements. Source data and material that documents the research process and the project’s various steps should instead be regarded as documents (submitted, upheld) belonging to the organisation and fall under the Public Access to Information and Secrecy Act and the Archives Act. The material from a completed research project should therefore be stored and archived, with subsequent preservation and occasional sorting.

If it is integrity-sensitive, there are also specific requirements for how it should be stored. Information on this is provided by the Data Inspection Board, among others. There are many reasons to keep material. For instance, it must be possible to verify research results6, or the material might be requested in the investigation of an accusation of research misconduct. It can also happen that the researcher who obtained the results, or other researchers, wish to reuse the material in another project. As a rule, this type of reuse requires a new ethics review. The material may also be of great value in itself, for example if it documents current societal conditions, in which future generations may have an interest. Whether, when and how an organisation may sort material is addressed in the Archives Act. If material is sorting, and that these procedures are known and observed by their researchers. Making data material collected available to other researchers contributes to facilitating both the scrutiny and…”

(V) “In general, GDPR reinforces the protection of integrity via the various requirements set by the Regulation to ensure the personal data handling is legal. It applies to areas such as the obligation to inform, and technical and organisational protective measures, etc. At the same time as the new regulatory framework is comprehensive and complicated, it should be noted that research receives favourable treatment in several different respects, such as the issues of handling sensitive personal data. In addition to the EU General Data Protection Regulation, which will apply with legal force in Sweden, work is in progress on national supplementary legislation, and a further special regulation focusing on the handling of research data. Ultimately, it concerns the requirements set for permitting personal data handling for research purposes.”

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V “Personal data handling Research often involves the handling of personal data. Personal data is anything that can be linked, directly or indirectly, to a physical person, such as address, de-coded data where the code key remains, or data that together with other information can identify an individual. Handling is more or less anything that can be done with personal data, such as storing, summarising and transferring. Special rules apply for the handling of personal identity numbers, sensitive personal data and data concerning breaches of the law. Permission from an ethics review board is also needed when handling the latter two in research. When personal data is handled, there are a number of regulations that must be complied with. There are both general rules – international, at EU level, and national – and also regulations for the handling of personal data for certain types of purposes. In Sweden, the handling of personal data is currently regulated by the Personal Data Act (SFS 1998:204) and the Personal Data Ordinance (SFS 1998:1191), and in a number of enactments with special provisions for the handling of personal data in various situations. As from May 2018, a new EU Regulation on general data protection7 will replace the current Data Protection Directive, which you can read more about in Section 9.1.8, as well as the Swedish Personal Data Act and the Personal Data Ordinance. A consequence of this will also be that all the regulations that govern personal data handling will be reviewed and adapted to the new Regulation”.

V “Legal support for personal data handling The handling of personal data is governed by the Personal Data Act, but if there are provisions in another law or ordinance that regulates personal data handling, these latter provisions shall apply; see Section 2 of the Personal Data Act. This means that the handling of personal data must be supported either by the Personal Data Act or by another law or ordinance that regulates the handling.”

V “…whatever his nationality or residence, respect for his rights and fundamental freedoms, and in particular his right to privacy, with regard to automatic processing of personal data relating to him ("data protection”)”. According to Article 2, the Convention’s area of application is "automated data files" and "automatic processing" of personal data in public and private activities. Each Convention state may, however, introduce certain general restrictions or expansions of the area of implementation. The central part of the Convention is Chapter II (Articles 4–11), which comprise the fundamental principles for data protection. They include requirements that personal data that is processed automatically shall be “obtained and processed fairly and lawfully”, “adequate, relevant and not excessive in relation to the purposes for which they are stored” and “preserved ... for no longer than is required” (Article 5). Personal data “revealing racial origin, political opinions ... health or sexual life”, as well as “personal data relating to criminal convictions” “may not be processed automatically unless domestic law provides appropriate safeguards” (Article 6). The Convention also includes provisions governing requirements on safety measures and information to those whose data is being processed.”

V “9.1.8 The Data Protection Directive On 24 October 1995, the EU adopted a Directive on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, the Data Protection Directive. The provisions of the Data Protection Directive set the framework for what is possible to do in Sweden in terms of handling personal data. It is therefore not possible to create Swedish legal provisions that are not compatible with the Directive. The Data Protection Directive includes a number of fundamental requirements that must be fulfilled in the handling of personal data. These rules are largely represented in the Swedish Personal Data Act. As mentioned in Section 9.1, the Data Protection Directive will be replaced by a new EU Regulation on data protection.
9.2 Two important Swedish laws As mentioned above, in Sweden the Data Protection Directive has been implemented through the Personal Data Act. This is the law that generally regulated the handling of personal data in Sweden. There are also a number of laws that regulate the handling of personal data for specific purposes. The Act is also applicable to research that involves physical encroachment on a research subject, that is carried out using a method aimed at influencing the research subject physically or mentally, or that entails a clear risk of physical or mental harm to the research subject, that relates to studies of biological material taken from a living person that can be attributed to this person, that involves a physical encroachment on a deceased person, or relates to studies of biological material taken for medical purposes from a deceased person that can be attributed to this person. By means of the ethics review procedure, support can be created for personal data handling in research this follows from special regulations, such as those in the Patient Data Act. This must instead be regulated between the employee and the employer in such a way that the private employer ensures that data that shall not be disseminated are kept secret.”

UNITED KINGDOM

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(V) “transparency and open communication …in the reporting of research data collection methods; in the analysis and interpretation of data; in making research findings widely available, which includes publishing or otherwise sharing negative or null results to recognise their value as part of the research process; and in presenting the work to other researchers and to the public”.

V “FAIR Guiding Principles for scientific data management and the relevant regulations to ensure their reproducibility and/or verifiability (depending on the discipline), reliability, and accuracy. Institutions and funding organisations should provide or enable access to a storage infrastructure for these data.”

V “Institutions and funding organisations should communicate their data management requirements and comply with the FAIR principles17 stewardship inspired by the concepts of Open Data and Open Science. “

V “Scientists should adhere to the FAIR principles when making their research data available, provided that there are no rights (such as copyright, data protection, or contractual rights) preventing publication.“

V “If research data or data sources cannot be disclosed or made accessible either immediately or after a certain period of time,18 possible – as long as there are no important reasons to the contrary – for research results to be verified. Persons and institutions entitled to receive research data or data sources are responsible for their safekeeping and/or, where necessary, their destruction.”

V “The following behaviours related to the handling of data or materials are examples of scientific misconduct: • omitting or withholding data and data sources; • obtaining and processing personal data without obtaining informed consent;29 • copying, passing on, or using data without authorisation; • insufficient pseudonymisation/anonymisation of data; • violating disclosure obligations (→ 4.5 Data management); • storing data inadequately; • violating the obligation to retain data (→ 4.5 Data management) or materials, such as disposing data and materials before the expiry of a mandatory retention period. • obstructing collaboration by withholding research results; • refusing to allow authorised persons to examine research data and results;”

BELGIUM

V “Researchers’ work is deemed to be verifiable when it allows colleagues to follow the progress of the research and to reproduce it, if need be”.

V “The primary data of a research project and the protocols must be kept and made accessible during a determined and sufficient period of time. When publications, especially review and summary articles, do not contain all the necessary data for verification, the data should nevertheless be available”.

DENMARK

(V) “Primary materials and data should be retained, stored and managed in a clear and accurate form that allows the result to be assessed, the procedures to be retraced and – when relevant and applicable – the research to be reproduced.”

V “The extent to which primary materials and data are retained and the recommended retaining period should always be determined by the current practices applicable to the specific field of research. However, data should in general be kept for a period of at least five years from the date of publication.”

(V) “The data records should enable identification of persons having conducted the research and persons or institutions with responsibility for the primary materials, data, and research results. The data records should contain a precise and traceable reference to the source. Any changes to the primary materials or data stored should be clearly accounted for in a way that allows clear identification of the changes made.”

(V) ”i. Researchers are responsible for storing their primary materials and data.
ii. Researchers are – unless otherwise regulated – responsible for deciding the extent to and duration for which primary material is to be retained. When deciding this, researchers should consider the value of the primary materials for assessing the results of the research and the physical and technical possibility of storage at the institution.iii. Institutions should maintain a policy on the retention of primary materials and data that includes information on:

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a. Storage of primary materials and data b. Secure and safe disposal of primary materials and data after the retention period c. Responsibility for and access to primary materials and data d. Data retention, accessibility and ownership when researchers leave the institution iv. Institutions are responsible for providing secure data storage facilities that are consistent with confidentiality requirements and applicable regulations and guidelines, e.g. on the processing of personal data. v. Institutions should allow access to the stored primary materials and data, except when this is in conflict with contractual legal obligations or current regulations on for example ethical, confidentiality or privacy matters or intellectual property rights."

(V) "Recycling or re-use of primary materials, data, interpretations or results should be clearly disclosed."

FRANCE

V "The reliability of data produced by researchers relies on the implementation of appropriate research protocols taking into account acquired and proven knowledge. Data production procedures must be described in clear and explicit terms so they can be replicated by other researchers and re-used."

(V) "Archiving, traceability of raw data and the use of an unforgeable laboratory notebook are the only legal ways to prove the prior existence of results in the context of a contract, a patent application or a dispute."

V "Data identification. A Digital Object Identifier (DOI) ensures the constant and unique traceability of digital objects. The DOI allows individuals to access, share, re-use and cite online resources, research data and publications. It also ensures long-term access to scientific materials such as images and videos. Its use is therefore recommended."

V "The following behaviours are detrimental to the credibility of research and, in extreme cases, may even be considered fraud.
Examples of inappropriate data management practices
• Denying data access to colleagues. • Producing biased or manipulated data under the pressure exerted by sponsors funding the research. • Interfering with or obstructing other researchers' work, especially by making data, research material or equipment unavailable or unusable. • Using data belonging to a third party without prior authorisation or without citing the author and sources."

V "Research is increasingly reliant on the use of 'big data', a term that generally refers to an aggregation of data acquired by teams located all over the world who agree to data sharing, i.e. making their data available to all. Data from research financed through public funding must be made freely available, which is the very principle of open data. Indeed, this is stated in the French Research Code (Art. L.112-1) and forms part of the objectives of both the European Horizon 2020 programme, and the French Digital Republic Act of 201613, which makes access to scientific data mandatory (Art. 9).
The use of big data, from production to sharing, must fulfill the requirements for scientific relevance, rigour and loyalty. It must also satisfy the need for security as well as ethical and legal considerations. The Charter for Ethics & Big Data 14 was issued to facilitate the creation, dissemination and use of big data while complying with legal and ethical requirements. By adopting this charter, users undertake to adhere to the following principles."

V "Four international organisations have signed the "Open data in a big data world" agreement15, which lays down the basic principles to be adopted when using open data, along with recommendations on how to combine scientific rigour and ethics. However, these principles are not fully compatible with those of France's National Commission for Information Technology and Civil Liberties (CNIL) in the case of personal data".

V "Raw data must be accessible insofar as the discipline allows."

AUSTRIA

V "The presentation of the sources, materials, data, and arguments should be precise and scrupulous. The methods used and the respective steps of the entire research process must be clear. The manner in which the outcome was achieved and its interpretation should be presented in a transparent way. As a rule, the results and the manner in which they were achieved are to be described in as much detail as possible to make the collection and analysis of the research data and materials reproducible. This means, for instance, that researchers explicitly

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disclose all relevant research data and materials—in particular, those that could possibly lead to other conclusions."

V "data and materials should be included in the publication so they can be used for any metaanalyses."

V "With regard to the publication and dissemination of research results, research institutions should ensure that contracts with the clients and funding organisations contain fair agreements about the rights, access, publication, and reuse of data and research materials and that the research results are disseminated to a broad public in a scrupulous way".

V "the unjustified refusal to provide access to primary and original data including information on how such data was obtained, or the disposal of such data before the applicable retention periods have passed;

V "Research data management is particularly important for quality assurance. This begins with the definition of and the plan for the research data in paper-based or electronic form. An integrated plausibility check makes a significant contribution to ensuring data quality. Following the completion of a study, the research data and materials should be safeguarded in a way that prevents subsequent manipulation. In addition, it should be ensured that the original data are still available in a machine-readable format, whenever possible, even after an extended period of time. As part of this storage, the corresponding metadata should also be archived in a sustainable and accessible manner. The legal provisions, especially the General Data Protection Regulation, must be observed when dealing with personal data (for instance, qualitative interviews)."

V "It is recommended that the institutions provide the appropriate infrastructure to ensure good data management. Such data management allows for the permanent storage and management of research data and materials and the corresponding metadata, regardless of whether these are published or not. The Austrian Agency for Research Integrity recommends ten years as an appropriate retention period."

V "It should also be ensured that the data are accessible in accordance with the FAIR Principles (Findable, Accessible, Interoperable, Re-usable) and the necessary confidentiality is maintained. The research institutions should provide information on the form in which the research data and materials must be available."

V "The publications (including the underlying research data and materials as well as the corresponding metadata) in the form of journal articles, monographs, anthologies, proceedings, or similar publications are made available on a permanent and open basis under an open license for easy reuse"

V "In addition to publications, research data and materials including the corresponding metadata are a key component in the verifiability and reproducibility of research results (see Section Fehler! Verweisquelle konnte nicht gefunden werden.). Research data and materials should, at the very least, always be made freely accessible when they serve as the basis of scholarly publications and there are not any legal, ethical, or other documented reasons preventing their availability. This means that according to the FAIR Principles they must, for instance, be made open access simultaneously with the publishing of the publication; be archived in a registered repository; be able to be reused without restrictions; and be citable by a persistent identifier."

ESTONIA

(V) "preserves primary data and documentation of all substantial published results for an allotted time in the respective discipline of science unless other obligations or rules preclude this; "

V "The researcher ensures the methodological transparency of research and describes the stages of data collection and their analysis as exactly as possible. 1.3.4 The researcher assesses whether research objectives can be achieved by reuse of data or new data have to be collected. To use public data collections as broadly as possible and to save resources, the researcher prefers reuse of data if research questions make it feasible. If personalised data are reused, the researcher follows the regulations and restrictions of data protection."

V "The researcher records the collection and analysis of data as precisely as possible and ensures the transparency of data analysis so that the quality of the data could be checked and, if necessary, their analysis be repeated. 2.2.4 The researcher describes and formats the collected data so that they could be used as openly and broadly as possible, and refers to the used data accurately. 2.2.5 In research, the researcher follows the

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principles and regulations of protection of personal data." 2.2.6 The researcher ensures as broad access to data as possible, considering the substantiated limitations of access to the data resulting from the need to protect personal data, promises given to the subjects and the interests of research. 2.2.7 The researcher, in cooperation with the research institution, stores research data as long as possible; when setting the storage time, s/he considers the value of data for research, the conventions of one's research area, the physical and technological facilities of the research institution and agreements with subjects or holders of data. The researcher stores personalised data as long as necessary and as briefly as possible. 2.2.8 When storing and using data, the researcher ensures their integrity and safety and, if necessary, ensures the safe and proper destruction of data. 2.2.9 The researcher takes care that research data could be found and used as easily as possible."

GERMANY

V "The origin of the data, organisms, materials and software used in the research process is disclosed and the reuse of data is clearly indicated; original sources are cited. The nature and the scope of research data generated during the research process are described. Research data are handled in accordance with the requirements of the relevant subject area. The source code of publicly available software must be persistent, citable and documented. Depending on the particular subject area, it is an essential part of quality assurance that results or findings can be replicated or confirmed by other researchers (for example with the aid of a detailed description of materials and methods)."

(V) "In particular, the researcher who collected the data is entitled to use them. During a research project, those entitled to use the data decide whether third parties should have access to them (subject to data protection regulations). "

V "An important basis for enabling replication is to make available the information necessary to understand the research (including the research data used or generated, the methodological, evaluation and analytical steps taken, and, if relevant, the development of the hypothesis), to ensure that citations are clear, and, as far as possible, to enable third parties to access this information. Where research software is being developed, the source code is documented."

V "In the interest of transparency and to enable research to be referred to and reused by others, whenever possible researchers make the research data and principal materials on which a publication is based available in recognised archives and repositories in accordance with the FAIR principles (Findable, Accessible, Interoperable, Reusable). Restrictions may apply to public availability in the case of patent applications".

V "Researchers back up research data and results made publicly available, as well as the central materials on which they are based and the research software used, by adequate means according to the standards of the relevant subject area, and retain them for an appropriate period of time. Where justifiable reasons exist for not archiving particular data, researchers explain these reasons. HEIs and non-HEI research institutions ensure that the infrastructure necessary to enable archiving is in place. Explanations: When scientific and academic findings are made publicly available, the research data (generally raw data) on which they are based are generally archived in an accessible and identifiable manner for a period of ten years at the institution where the data were produced or in cross-location repositories. This practice may differ depending on the subject area. In justified cases, shorter archiving periods may be appropriate; the reasons for this are described clearly and comprehensibly. The archiving period begins on the date when the results are made publicly available. "

HUNGARY

(V) "In the case of sciences performing experiments and observations, - data shall be accurately documented so that the research can be controlled. Data and other documentation materials produced during the research, both those contained in electronic data storage devices and hard copies shall be stored in a way that the damage, loss or manipulation thereof cannot occur. In case loss of data occurs, it must be documented separately."

V "Following the accomplishment of the research programme, data and other documentation materials necessary for the data to be controllable or repeatable or for the programme to be continued must be made available for such purposes."

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(V) “Inappropriate management of data Denial of handover of data to other researchers causing failure of the reconstruction of experimental results can be mentioned here. Improper storage of original data, alteration of data, neglecting data disturbing the outcome desired, distortion of data, and ignoring unexpected results can also be reckoned with here”.

– IMPORTANCE OF RESEARCH DATA AS RESEARCH OUTPUT AND/OR AS EVIDENCE

AUSTRIA

V “Open access of publications and data should be used as a separate category of research performance and assessed positively”.

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REPRODUCIBLE SCIENCE

LIST OF IDENTIFIED REFERENCES

– TRANSPARENCY AND REPRODUCIBILITY OF RESEARCH METHODS

ITALY

(V) “Laboratory notebooks and work notes; b. Documents, lists and registers containing collected and processed data, even if they have been anonymized during publication, in compliance with existing regulations (for example, sensitive patient data, sample characteristics, etc.); “

(V) “…publish data or results which have not actually been obtained or which have not been obtained using the methods described in the publication.”

NETHERLANDS

V “Transparency means, among other things, ensuring that it is clear to others what data the research was based on, how the data were obtained, what and how results were achieved and what role was played by external…”

V “If parts of the research or data are not to be made public, the researcher must provide a good account of why this is not possible. It must be evident, at least to peers, how the research was conducted and what the various phases of the research process were. At the very least, this means that the line of reasoning must be clear and that the steps in the research process must be verifiable.”

V “Be transparent about the method and working procedure followed and record them where relevant in research protocols, logs, lab journals or reports. The line of reasoning must be clear and the steps in the research process must be verifiable. This usually means that the research must be described in sufficient detail for it to be possible to replicate the data collection and its analysis.”

V “Ensure that it is clear how data, software codes and research material can be accessed.”

POLAND

V “Accountability in the conduct of research – researchers are expected to carry out their work in a diligently planned and possibly faultless manner. To ensure that these conditions are met, it is necessary to ensure: measurability in research planning, ability to select the appropriate research methods and methods applicable to the analysis of results, the exactness of measurements and compliance with relevant regulations and procedures”.

V “It is essential that the study design, collection of data and the conduct of research, including data analysis methods, be planned and documented (in analogous paper form or electronically), in a manner consistent with practices within the field of research“.

SPAIN

(V) “Science is based on empiricism and logical reasoning. Observation and experimentation in the laboratory or in the natural environment are aimed at obtaining data that will provide suitable answers to the scientific questions posed. For this reason, research must be carried out according to well designed and well-defined working protocols, which can be analysed and interpreted by any researcher in the scientific field in question. Experiments and observations must be carefully designed, with rigour and intelligence, with the ultimate aim of ensuring truthful and complete information, and making the best use of the resources available, and always bearing in mind the particularities of each activity.”

(V) “In scientific research, the data recorded from experiments and observations, as well as the materials and equipment used are the basis of the results and of any publications or patents. Therefore, the fundamentals of

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research design and interpretation need to be understandable and, where feasible, experiments should be reproducible."

(V) "The Institution and the research staff must ensure the proper conservation and management of all knowledge and materials generated in the research processes – including those unpublished – ensuring their protection and adequate access to them for a reasonable time period. In particular, where the information constitutes non-repeatable documentation, it must be kept permanently and securely and made available to other researchers. Data management should in any case facilitate search, accessibility, interoperability and reuse for other studies."

SWEDEN

(V) "Materials and methods must be described with sufficient clarity and detail to allow a reasonably well-informed reader to assess the scientific quality or significance of the results".

(V) "Experimental studies must also be presented in such a way that their reproducibility can be tested. The researcher should report all variables and conditions included in the study, and the deliberations carried out in order to determine the sample size. in empirical, non-experimental studies, for instance within the historical disciplines, source material and support for any claims made must be presented. These standards have to be met if it is to be possible for other researchers to check the results and assess the quality of the research and the significance of the results."

UNITED KINGDOM

V "transparency and open communication in declaring potential competing interests; in the reporting of research data collection methods; in the analysis and interpretation of data; in making research findings widely available, which includes publishing or otherwise sharing negative or null results to recognise their value as part of the research process; and in presenting the work to other researchers and to the public"

SWITZERLAND

(V) "the relevant regulations to ensure their reproducibility and/or verifiability (depending on the discipline), reliability, and accuracy. Institutions and funding organisations should provide or enable access to a storage infrastructure for these data possible – as long as there are no important reasons to the contrary – for research results to be verified. Persons and institutions entitled to receive research data or data sources are responsible for their safekeeping and/or, where necessary, their destruction."

BELGIUM

(V) "Researchers' work is deemed to be verifiable when it allows colleagues to follow the progress of the research and to reproduce it, if need be."

(V) "The information given should be verifiable. The results of the literature study, the hypotheses, the organisation of the research, the research and analysis methods, as well as the sources, are described in detail (in a research logbook, a laboratory diary or a progress report) so that other researchers can verify the accuracy of the process and reproduce it. If the subject of the observation is destroyed (for instance, during excavations), these observations must be recorded as well as possible. All the agreements and decisions must be written down and saved".

DENMARK

V "To ensure the credibility of scientific reasoning and to ensure that academic reflection is consistent with practice in the relevant field of research, all phases of research should be transparent.
This requires openness when reporting: • conflicts of interest • planning of research • research methods applied • results and conclusions".

(V) "Research should be documented in a manner consistent with practices in the field of research in question, e.g. by keeping records, logbooks, journals or similar practices – if possible with dates and entries by the person(s) responsible for the conduct of the research. To the extent possible, the documentation should allow the research to be examined and – when relevant – reproduced."

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FRANCE

V “The reliability of data produced by researchers relies on the implementation of appropriate research protocols taking into account acquired and proven knowledge. Data production procedures must be described in clear and explicit terms so they can be replicated by other researchers and re-used.”

V “Traceability defines all the information on data production conditions (methods, dates, etc.). In some disciplines—particularly in experimental research—traceability is ensured by a laboratory notebook, which may be a key part of quality assurance in research settings. The laboratory notebook is compulsory for all research staff, whether permanent or under contract. It serves both documentary and legal purposes. The raw data and conditions of original experiments must be so accurately recorded in the notebook that they may be replicated.”

V “Interfering with or obstructing other researchers' work, especially by making data, research material or equipment unavailable or unusable.”

V “Experimental protocols must be sufficiently well documented and open to allow other teams to reproduce them.”

AUSTRIA

V “Transparency means ensuring that it is clear what data, materials, and methods the research was based on and how the results were achieved. The line of reasoning must be clear, and the individual steps in the research process must be verifiable.”

V “The researchers should ensure that sources are verifiable and research data and materials used and collected are described as precisely and clearly as possible.”

V “The presentation of the sources, materials, data, and arguments should be precise and scrupulous. The methods used and the respective steps of the entire research process must be clear. The manner in which the outcome was achie sis of the research data and materials reproducible. This means, for instance, that researchers explicitly disclose all relevant research data and materials—in particular, those that could possibly lead to other conclusions (see Section Fehler! Verweisquelle konnte nicht gefunden werden.)”.

V “Precise documentation of a high quality study design ensures the reproducibility and thus the credibility of research results.”

V “A further aim should be to provide open access to the entire research cycle as far as possible”.

V “The publications (including the underlying research data and materials as well as the corresponding metadata) in the form of journal articles, monographs, anthologies, proceedings, or similar publications are made available on a permanent and open basis under an open license for easy reuse.”

GERMANY

(V) “The source code of publicly available software must be persistent, citable and documented. Depending on the particular subject area, it is an essential part of quality assurance that results or findings can be replicated or confirmed by other researchers (for example with the aid of a detailed description of materials and methods)”.

(V) “An important basis for enabling replication is to make available the information necessary to understand the research (including the research data used or generated, the methodological, evaluation and analytical steps taken, and, if relevant, the development of the hypothesis), to ensure that citations are clear, and, as far as possible, to enable third parties to access this information. Where research software is being developed, the source code is documented”.

– TRANSPARENCY AND REPRODUCIBILITY OF RESEARCH TOOLS

IRELAND

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(V) “The “National Framework on the Transition to an Open Research Environment” underlines the importance of making research data “as open as possible, as restricted as necessary”. Open access to research data should lead to greater integrity in the gathering, analysis and presentation of data as it may be open to scrutiny by peers, globally. It should also facilitate reuse of data for further research, contribute to public knowledge and inform policy and practice.”

ITALY

(V) “Define procedures and roles and assign duties for the processing and storage of material and data: researchers identify and formally appoint individuals in charge of the use, management and storage of material and data produced by the research. Similarly, the roles of the individual participants are established, as well as any access to data by third parties. Measures, tools and methods for the optimal conservation of raw data are specified.”

(V) “Such practices are deemed as falsification wherever it is demonstrated that they have been adopted with the aim of presenting research results in a misleading manner. Also included in this category are omissions in the publication of substantial parts of the results or details relating to the research methods wherever such omissions are aimed at deliberately distorting the results and the conclusions of the publication”

NETHERLANDS

V “Transparency means, among other things, ensuring that it is clear to others what data the research was based on, how the data were obtained, what and how results were achieved and what role was played by external…”

V “If parts of the research or data are not to be made public, the researcher must provide a good account of why this is not possible. It must be evident, at least to peers, how the research was conducted and what the various phases of the research process were. At the very least, this means that the line of reasoning must be clear and that the steps in the research process must be verifiable.”

V “Be transparent about the method and working procedure followed and record them where relevant in research protocols, logs, lab journals or reports. The line of reasoning must be clear and the steps in the research process must be verifiable. This usually means that the research must be described in sufficient detail for it to be possible to replicate the data collection and its analysis.”

V “Ensure that it is clear how data, software codes and research material can be accessed.”

POLAND

V “Accountability in the conduct of research – researchers are expected to carry out their work in a diligently planned and possibly faultless manner. To ensure that these conditions are met, it is necessary to ensure: measurability in research planning, ability to select the appropriate research methods and methods applicable to the analysis of results, the exactness of measurements and compliance with relevant regulations and procedures.”

V “It is essential that the study design, collection of data and the conduct of research, including data analysis methods, be planned and documented (in analogous paper form or electronically), in a manner consistent with practices within the field of research8. “

V “Primary materials and data should be retained and stored in an accurate form that allows the result to be assessed, the procedures to be retracted and, when relevant and applicable – the research to be reproduced. Primary materials and data obtained by research must be protected”.

V “Primary materials and data must be documented in a manner that allows identification of the researcher or the research institution in charge of collecting the primary material and data, and for the analysis of the final results. The data records should contain a precise and traceable reference to the source of the primary materials. Any changes to the primary materials or data stored should be clearly accounted for in a way that allows clear identification of the changes made12. “In the procedure concerning the charge of the infringement of research integrity rules, the lack of such data is treated as an incriminating circumstance”.

SPAIN

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(V) “In scientific research, the data recorded from experiments and observations, as well as the materials and equipment used are the basis of the results and of any publications or patents. Therefore, the fundamentals of research design and interpretation need to be understandable and, where feasible, experiments should be reproducible.”

SWEDEN

(V) “Materials and methods must be described with sufficient clarity and detail to allow a reasonably well-informed reader to assess the scientific quality or significance of the results”.

(V) “Experimental studies must also be presented in such a way that their reproducibility can be tested. The researcher should report all variables and conditions included in the study, and the deliberations carried out in order to determine the sample size. in empirical, non-experimental studies, for instance within the historical disciplines, source material and support for any claims made must be presented. These standards have to be met if it is to be possible for other researchers to check the results and assess the quality of the research and the significance of the results.”

UNITED KINGDOM

V “transparency and open communication in declaring potential competing interests; in the reporting of research data collection methods; in the analysis and interpretation of data; in making research findings widely available, which includes publishing or otherwise sharing negative or null results to recognise their value as part of the research process; and in presenting the work to other researchers and to the public”

SWITZERLAND

V “the relevant regulations to ensure their reproducibility and/or verifiability (depending on the discipline), reliability, and accuracy. Institutions and funding organisations should provide or enable access to a storage infrastructure for these data possible – as long as there are no important reasons to the contrary – for research results to be verified. Persons and institutions entitled to receive research data or data sources are responsible for their safekeeping and/or, where necessary, their destruction.”

V ”RELIABILITY in ensuring the quality of research and teaching in order to maximise the credibility of, and trust in, science. Reliability is reflected in particular in the design, methodology, and analysis of research; it involves both transparency and traceability.”

V “the relevant regulations to ensure their reproducibility and/or verifiability (depending on the discipline), reliability, and accuracy. Institutions and funding organisations should provide or enable access to a storage infrastructure for these data.”

BELGIUM

(V) “The information given should be verifiable. The results of the literature study, the hypotheses, the organisation of the research, the research and analysis methods, as well as the sources, are described in detail (in a research logbook, a laboratory diary or a progress report) so that other researchers can verify the accuracy of the process and reproduce it. If the subject of the observation is destroyed (for instance, during excavations), these observations must be recorded as well as possible. All the agreements and decisions must be written down and saved”.

DENMARK

V “To ensure the credibility of scientific reasoning and to ensure that academic reflection is consistent with practice in the relevant field of research, all phases of research should be transparent.
This requires openness when reporting: • conflicts of interest • planning of research • research methods applied • results and conclusions”.

(V) “Research should be documented in a manner consistent with practices in the field of research in question, e.g. by keeping records, logbooks, journals or similar practices – if possible with dates and entries by the person(s)

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responsible for the conduct of the research. To the extent possible, the documentation should allow the research to be examined and – when relevant – reproduced."

FRANCE

V "The reliability of data produced by researchers relies on the implementation of appropriate research protocols taking into account acquired and proven knowledge. Data production procedures must be described in clear and explicit terms so they can be replicated by other researchers and re-used."

V "Traceability defines all the information on data production conditions (methods, dates, etc.). In some disciplines—particularly in experimental research—traceability is ensured by a laboratory notebook, which may be a key part of quality assurance in research settings. The laboratory notebook is compulsory for all research staff, whether permanent or under contract. It serves both documentary and legal purposes. The raw data and conditions of original experiments must be so accurately recorded in the notebook that they may be replicated."

V "Interfering with or obstructing other researchers' work, especially by making data, research material or equipment unavailable or unusable."

V "Experimental protocols must be sufficiently well documented and open to allow other teams to reproduce them."

AUSTRIA

V "Transparency means ensuring that it is clear what data, materials, and methods the research was based on and how the results were achieved. The line of reasoning must be clear, and the individual steps in the research process must be verifiable."

V "The researchers should ensure that sources are verifiable and research data and materials used and collected are described as precisely and clearly as possible."

V "The presentation of the sources, materials, data, and arguments should be precise and scrupulous. The methods used and the respective steps of the entire research process must be clear. The manner in which the outcome was achie sis of the research data and materials reproducible. This means, for instance, that researchers explicitly disclose all relevant research data and materials—in particular, those that could possibly lead to other conclusions (see Section Fehler! Verweisquelle konnte nicht gefunden werden.)".

V "Precise documentation of a high quality study design ensures the reproducibility and thus the credibility of research results."

V "A further aim should be to provide open access to the entire research cycle as far as possible".

V "The publications (including the underlying research data and materials as well as the corresponding metadata) in the form of journal articles, monographs, anthologies, proceedings, or similar publications are made available on a permanent and open basis under an open license for easy reuse."

GERMANY

(V) "The source code of publicly available software must be persistent, citable and documented. Depending on the particular subject area, it is an essential part of quality assurance that results or findings can be replicated or confirmed by other researchers (for example with the aid of a detailed description of materials and methods)".

(V) "An important basis for enabling replication is to make available the information necessary to understand the research (including the research data used or generated, the methodological, evaluation and analytical steps taken, and, if relevant, the development of the hypothesis), to ensure that citations are clear, and, as far as possible, to enable third parties to access this information. Where research software is being developed, the source code is documented."

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OPEN EVALUATION

LIST OF IDENTIFIED REFERENCES

– TRANSPARENCY OF RESEARCH EVALUATIONS AND/OR PEER REVIEW

FRANCE

V “Some recommendations for scientific evaluators;…Transparency; conclusions must be explained and justified so that they can be defended in the event of an appeal. Those researchers concerned must have access to the elements upon which the evaluation is based.”

– CONTENT-BASED EVALUATION

SPAIN

V “During the evaluation process, each and every candidate shall be evaluated, considering their scientific environment. Under no circumstances shall the evaluation be based solely on bibliometric criteria. If the evaluation process involves a personal interview, the evaluation criteria must be established in advance.” **FRANCE**

V “In the light of the frequent inappropriate use of bibliometric indicators when evaluating research, publishers of scientific journals, academies and institutions all over the world published in 2013 the "San Francisco Declaration on Research Assessment” (DORA), which calls on evaluators not to use the IF to evaluate researchers' activity. The Leiden Manifesto33 has set out general principles that should enable a better use of bibliometric indicators when evaluating research.”

V “Quantitative evaluation should support qualitative, expert assessment.”

V “Base assessment of individual researchers on a qualitative judgement of their portfolio”.

V “Recognise the systemic effects of assessment and indicators.”

V “Scrutinise indicators regularly and update them”.

AUSTRIA

(V) “In general, the assessment of research performance should focus primarily on the quality of the research. If non-research related factors are used, these must be explained and be made transparent.”

GERMANY

V “To assess the performance of researchers, a multidimensional approach is called for; in addition to academic and scientific achievements, other aspects may be taken into consideration. Performance is assessed primarily on the basis of qualitative measures, while quantitative indicators may be incorporated into the overall assessment only with appropriate differentiation and reflection. Where provided voluntarily, individual circumstances stated in curricula vitae – as well as the categories specified in the German General Equal Treatment Act (Allgemeines Gleichbehandlungsgesetz) – are taken into account when forming a judgement.”

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CITIZEN SCIENCE & OPEN COLLABORATION

LIST OF IDENTIFIED REFERENCES

– ACCESS TO RESEARCH PROCESSES AND/OR RESEARCH INFRASTRUCTURE AND TOOLS

DENMARK

(V) “To ensure the credibility of scientific reasoning and to ensure that academic reflection is consistent with practice in the relevant field of research, all phases of research should be transparent. This requires openness when reporting: • conflicts of interest • planning of research • research methods applied • results and conclusions.”

FRANCE

(V) “Interfering with or obstructing other researchers' work, especially by making data, research material or equipment unavailable or unusable.”

“Experimental protocols must be sufficiently well documented and open to allow other teams to reproduce them.”

AUSTRIA

(V) “A further aim should be to provide open access to the entire research cycle as far as possible.”

– SHARED AND RECIPROCATED BENEFITS OF RESEARCH

POLAND

(V) “Collaborating partners should – if feasible, and preferably as early as possible in the research process – establish agreement on all relevant areas and specify how they understand research integrity that will be applied throughout the collaborative research. Responsibilities All collaborating partners are responsible for the integrity of the collaborative research. Already at the initial stage of the collaboration partners should agree on all the matters governed by regulations and guidelines on research integrity, especially in the case of international cooperation42. When necessary, common agreements should be established on the following: a. Intellectual property rights; b. Procedures related to legal regulations; c. Procedures for resolution of conflicts of interests between collaborating partners; d. d. Publication authorship; e. Sharing and use of findings, management and proprietary rights; f. Confidentiality; g. Procedures for reporting and handling breaches of research integrity and rules of conduct when breach of integrity is found.”

SWEDEN

(V) “Collaborators contribute to the common undertaking “when the spirit moves them”. If the project involves postgraduate students or researchers in the early stages of their careers, this is totally unacceptable. They are so dependent on being able to produce a track record of publications and other results in order to be able to continue at all, that collaborative projects in which they participate must involve a realistic sharing of the workload and a viable and quite strictly regulated time plan.”

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BELGIUM

(V) “A code of ethics does not only contribute to the quality of the scientific research, but also to its legitimation: it demonstrates to citizens, who finance the majority of research and reap the benefits, that the world of research is developing its own tools to guarantee responsible research.”

DENMARK

(V) “i. All collaborating partners should – to the extent possible – take responsibility for the integrity of the collaborative research.
ii. Collaborating partners should – if feasible and preferably as early as possible in the research process – establish agreements on all relevant areas, and specify how responsible conduct of research will be applied throughout the collaborative research.2
iii. Where appropriate, common agreements should – in addition to standard agreements on the practical implementation of the research – be established on the following:
a. Intellectual property rights b. Procedures for addressing conflicting laws, regulations, practices, etc. c. Procedures for resolution of conflicts between collaborating partners d. Publication issues e. Use, sharing, ownership and management of data f. Confidentiality g. Conflicts of interest.”

FRANCE

(V) “Researchers today therefore have a strong responsibility to the scientific fields in which they have chosen to work. It is also important to emphasise researchers’ responsibility to society. One of the aims of science is indubitably to contribute to the common good of humankind. Yet the relationship between science and society has altered profoundly over the course of history. The advances in technology that result from scientific discoveries cannot generally be foreseen. Today, the notion of progress has been called into question due to growing awareness of the impact of technologies on the environment and human health.”

(V) “There is an urgent need to consolidate the relationship of trust between scientists and citizens. In a world shaken by successive crises and controversies on sensitive matters, researchers have to listen to the public’s questions on the impact of their research. Now that the public has become aware of new types of risk, public opinion has become increasingly divided between admiration for the meteoric progress of science and worry over some of its applications. Moreover, the complexity of phenomena means that unequivocal answers to scientific controversies are not always possible. Without denying the autonomy of the scientific world, and as recalled by UNESCO’s 1974 Recommendation on the Status of Scientific Researchers, updated in 2016, researchers should give serious thought to the responsibility that frames their intrinsic liberty.”

AUSTRIA

(V) “Furthermore, the stronger involvement of relevant stakeholders and interested laypeople as well as patient groups can contribute to improving scientific knowledge. Another important argument for more interaction between researchers and the public is that disinformation is growing in influence due to social media. It is therefore the responsibility of researchers to counter this false information with their scholarly expertise.”

V “Other ways of involving the non-scientific public are participatory approaches, such as citizen science, citizens’ conferences, or participatory technology assessment, which are characterised by the active inclusion of practical knowledge and/or interested citizens in the carrying out of research projects. Citizen science or other similar transdisciplinary approaches should be used especially in situations where they are a suitable method for answering research questions. In addition, efforts can be made to find new approaches for involving the public in research funding in an appropriate manner. Ideally, this would not only make science and research more transparent but also more understandable. This, in turn, helps the public to make connections between science and research and their lives.”

HUNGARY

(V) “Scientific research is an activity carried out by individuals not in isolation but in synergy or co-operation with other researchers. In its mode of reasoning and processes, science is not tied to national borders. The scientific community determines the proper methodology of research and confirms its results. It follows that scientific

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research is able to contribute to human knowledge if its results become available to others as well so that its value of truth can be judged with a high degree of certainty."

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SCIENCE COMMUNICATION

– PROACTIVE AND TARGETED SOCIETAL OUTREACH

ITALY

(V) “1. Express yourself appropriately: Researchers shall limit their contribution and public statements exclusively to the fields of their professional competence. A clear and open distinction is made between the communication of personal opinions and the communication of professional opinions that is based on publications that have already been peer-reviewed and/or on data obtained by methods generally accepted by the scientific community, codified by documented and documentable criteria, and whose effectiveness, reliability and margin of error have been established experimentally.”

(V) “2. Communicating in a balanced manner: in addition to guaranteeing a clear distinction between personal opinions and scientific evidence, whenever they address the general public, researchers shall base their style of expression on clarity, honesty, objectivity, rigour and transparency.”

LATVIA

V “A scientist must respect the right of the community to be informed about scientific achievements and must enhance opportunities to enforce these rights, acting against deception of the community or the delay of information, or its distortion.”

V “A scientist must use their knowledge, intellect and authority for the benefit of the community.”

NORWAY

V “Availability of results. As a main rule, research results should be made available. Openness regarding research findings is essential for ensuring verifiability, for returning some benefit to the research participants and society in general, and for ensuring a dialogue with the public. Such communication is also a function of democracy”.

DENMARK

V “Publication and communication are essential for enabling the research community to scrutinize and discuss research results. Thus, researchers have a right and an obligation to publish and communicate their results to the research community, to professional practitioners, and to society at large”.

V “Research can be communicated through various channels ranging from strictly professional contexts aimed at peers to more popular research communication aimed at a broader audience. Although form, expression and level of detail may differ according to channels employed and audiences addressed, the standards for responsible conduct of research should always be respected when communicating research.”

FRANCE

V “Researchers are ethically obliged to make their research findings available to both the scientific community and the public. Those who receive public funding are legally obliged to do so. The development of digital technologies has transformed the way results are communicated”.

V “Researchers must make their knowledge and research activities available to the public, so that nonexperts can understand the evidence and advantages25. Public research staff benefit from the freedom of expression and opinion but also have a duty to ensure discretion, confidentiality, neutrality and transparency about their personal links of interests.”

AUSTRIA

V “A substantial portion of the research in Austria is funded by the public sector. For this reason, among others, it is recommended to involve the non-scientific public in an open and transparent manner. Such involvement is also important because research results can have a wide range of implications for society and each individual”.

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V “Another important argument for more interaction between researchers and the public is that disinformation is growing in influence due to social media. It is therefore the responsibility of researchers to counter this false information with their scholarly expertise”.

CZECH REPUBLIC

V “publishes with the aim to pass on the results and knowledge to the professional public, not only for the purpose of demonstrating works as scientific outputs.”

– SCIENTIFIC KNOWLEDGE IS UNIVERSALLY UNDERSTANDABLE

NETHERLANDS

(V) “Be honest in public communication and clear about the limitations of the research and your own expertise. Only communicate to the general public about the research results if there is sufficient certainty about them. “

(V) “Ensure that the public communication of research results is performed scrupulously”.

POLAND

V “Publication and communication are essential for enabling the research community to discuss research results. Research can be communicated through various channels, ranging from scientific publications or conference papers to more popular research communication aimed at a broader audience. Researchers are expected to ensure that their research results are made known to society at large in such a way that they can be understood by non-specialists.”

V “Communication is a form of conveying research results to society at large, usually in the spoken form, often with the use of media.”

SPAIN

V “Scientific information disseminated through social networks and internet portals must be proven, verified, updated and contextualized as required by scientific communication. Accessible and objective language shall be used in such a way that it can be understood by the non-specialised public and shall avoid distortion and sensationalist overstatement, as well as the improper disclosure of personal data.”

BELGIUM

V “In media communications or presentations, the researcher must present his/her research results in a truthful and comprehensible way. He/she must avoid arousing unjustified fears or hopes.”

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DENMARK

(V) “Research can be communicated through various channels ranging from strictly professional contexts aimed at peers to more popular research communication aimed at a broader audience. Although form, expression and level of detail may differ according to channels employed and audiences addressed, the standards for responsible conduct of research should always be respected when communicating research.”

FRANCE

V “Researchers must make their knowledge and research activities available to the public, so that nonexperts can understand the evidence and advantages”

V “Social networks and blogs are becoming an increasingly key source of information for the public and the media. Researchers should be aware of the impact that the information they communicate via these means can have, and are responsible for ensuring that is reliable and objective, in the interest of science and respect of their institution”.

AUSTRIA

V “With regard to the publication and dissemination of research results, research institutions should ensure that contracts with the clients and funding organisations contain fair agreements about the rights, access, publication, and reuse of data and research materials and that the research results are disseminated to a broad public in a scrupulous way.”

(V) “Another important argument for more interaction between researchers and the public is that disinformation is growing in influence due to social media. It is therefore the responsibility of researchers to counter this false information with their scholarly expertise”.

V “Science communication is an instrument suited for achieving these goals. This includes, in particular, the generally understandable communication of complex scientific content for an interested non-scientific audience. Researchers and research institutions should be encouraged to use different channels to address as wide a public as possible and raise their interest in science and research while at the same time being open to feedback from this same public”.

FINLAND

(V) “Besides research activity, the principles of responsible conduct of research apply to teaching materials, written and spoken statements, evaluations, CVs and publication lists, as well as to societal interaction in both printed and electronic publication channels, including the social media.”

(V) “misleading the general public by publicly presenting deceptive or distorted information concerning one’s own research results or the scientific importance or applicability of those results”

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OPEN EDUCATION

LIST OF IDENTIFIED REFERENCES

– OPEN EDUCATION

FRANCE

V “Teaching materials are copyright-protected. Authors can choose between different levels of protection for each teaching material using an appropriate CC licence. The re-use of materials for teaching or research purposes is permitted within the scope of the educational exception.”

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