



# Recognising Open Research Data in Research Assessment: Overview of Practices and Challenges

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## **Executive summary**

Amongst academic stakeholders including funders and research managers, there is consensus that research assessment needs to be reformed. The recognition of open research data (ORD) plays a major role in these discussions. Against that background, this literature review is the first deliverable of the swissuniversities project Recognise Open Research Data, recORD. The aim of recORD is to take a step forward to recommend how ORD practices should be recognised in research assessment in Swiss higher educational institutions (HEIs). The recORD project team consists of representatives of small and big universities, universities of applied sciences, as well as a federal institute of technology. In addition, the Swiss National Science Foundation (SNSF) as the major Swiss research funder and the Swiss Centre of Expertise in the Social Sciences (FORS), as an important research infrastructure, complement the views on the challenges and potential solutions for recognising ORD. recORD attempts to answer three main questions:

1. How to incentivise ORD in project assessment?
2. How to incentivise ORD in recruitment and career development assessment?
3. How to incentivise ORD in institutional assessment?

The literature review will inform the next steps of the project, most importantly a landscape analysis of the role of ORD in research assessment in Switzerland, and three thematic workshops, on research proposals, researchers' recruitment and career development, and institutional assessment respectively. At the end of the project, a final report will provide practical recommendations on how to better recognise ORD in research assessment across Switzerland.

This literature review starts from the observation that research assessment needs to be reformed as they are currently biased towards scientific publications. Internationally, discussions and projects thereon have emerged. To contextualise recORD and this literature review, we first describe international and Swiss initiatives for reforming research assessment and how they include ORD recognition. The remainder of the review follows an innovative methodology as it identifies first core values in responsible research assessment, and second existing frameworks, to thirdly derive propositions to keep in mind when developing concrete ORD-specific research assessment recommendations. In a final section, the review presents further readings and useful weblinks on the recognition of ORD in research assessment.

The frameworks are chosen along specific pre-defined criteria, the most important one is that they refer to ORD, which, as it turned out from the literature review, many frameworks on research assessment do not. The eight selected research assessment frameworks are:

- Open Science Career Assessment Matrix (OS-CAM)
- Norwegian Career Assessment Matrix (NOR-CAM)
- The two-step assessment procedure of the German Psychological Society
- LERU Framework for the Assessment of Researchers
- The Open and Universal Science (OPUS) framework
- HI-FRAME: A qualitative assessment of open science
- The SCOPE framework
- The Open Science Assessment Framework (OSAF)

Beginning with the earliest framework, OS-CAM developed in 2017, the presentation highlights the distinctions among the frameworks. Although most frameworks concentrate solely on assessing researchers without delving into specific indicators, they remain relevant and adaptable to other assessment levels. It is important to underline that HI-FRAME, developed by the University of Zurich, stands out as the only one focussing on open science, employing qualitative assessment approach, and providing concrete questions to guide the hiring process.

The identified core values of responsible research assessment are quality and impact, diversity and equity, and transparency and adaptability. Each of these values is connected to ORD and serves as a basis for discussing the frameworks. Examining the current assessment of ORD practices through these values, alongside the authors' expertise in social science research data management and archive, raise central questions and critical observations. This process also gives rise to reflections on the three assessment levels of interest within recORD. This analysis derives to the formulation of propositions, which read as follows:

- Proposition 1: Consider assessment levels and metrics pitfalls when selecting ORD-related indicators
- Proposition 2: Assess ORD quality through the FAIR principles, data curation, and data peer-reviewing
- Proposition 3: Be cautious when assessing ORD impact quantitatively
- Proposition 4: Account for ORD practices beyond research outputs

- Proposition 5: Acknowledge disciplinary heterogeneities in ORD practices
- Proposition 6: Ensure equitable ORD assessment of researchers
- Proposition 7: Promote responsible sharing of ORD
- Proposition 8: Guarantee transparent and iterative ORD assessment

These propositions constitute general guidelines for the next steps of the project. They will undergo further discussion in the upcoming recORD workshops, where perspectives and expertise from all recORD members will be incorporated. This collaborative process aims to formulate concrete and practical recommendations regarding the recognition and assessment of ORD practices across research proposals, researchers, and research units and institutions by the project's conclusion.



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# 1 Introduction

## 1.1 *The recORD project*

This document is the first deliverable of the work package 2 of the project *recognise ORD* (recORD), founded by the Chamber of universities (swissuniversities). This project spans 2024 and involves 12 Swiss higher education institutions (HEIs), the Swiss National Science Foundation (SNSF), and the Swiss Centre of Expertise in the Social Sciences (FORS) as a national research data infrastructure. The aim of recORD is to advance understanding within the Swiss context regarding how open research data (ORD) practices should be recognised and valued in the assessment of research proposals (level 1), the assessment of research personnel during recruitment and career development (level 2), and the assessment of research performing organisations (level 3).

Within this project framework, work package 2 provides three key deliverables: a *literature review* (deliverable 1) identifying content and key issues regarding the assessment of ORD practices nationally and internationally; a *landscape analysis* (deliverable 2) offering insights into the current state of research assessment regarding ORD at Swiss HEIs; and a *synthesis* of the results from the literature review and landscape analysis (deliverable 3).

## 1.2 *Aim of this review*

FORS has been mandated to conduct the literature review on ORD of the project RecORD. This review identifies the scope of ORD practices that are currently recognised or being implemented in research assessment. Research assessment is considered at three levels: research proposals, individual researchers (recruitment and career development), and research performing institutions (including research units within HEIs). Jointly, these levels provide a holistic picture on ORD in research assessment.

This literature review identifies international best-practices and points to various challenges in implementing incentives measures, and systems for valuating ORD. Ultimately, the results from the literature review will inform three recORD-workshops (work packages 3 to 5) dedicated to discussing avenues for assessing ORD practices at each level within the Swiss context.



### 1.3 Definitions

*Open science* encompasses a broad range of practices such as pre-registration of studies, sharing data, methodologies, and software, publishing negative or non-significant results, and fostering collaborative research environments (Fecher and Friesike, 2014). By promoting transparency, reproducibility, and collaboration, open science practices aim to improve scientific knowledge and make it more widely available (UNESCO, 2021).

*ORD practices* are integral components of open science. ORD practices can be defined as practices aimed at facilitating access to and reuse of research data by any interested party, contingent upon specific agreements based on the type of data (Fecher and Friesike, 2014). recORD and this literature review focus on ORD practices. Consequently, other open science practices, such as sharing methodologies, software, and codes, are not addressed in this review.

## 2 Methodology

The analysis presented here is based on a review of resources from past and current initiatives and projects aimed at reforming research assessment for research proposals, individual researchers, and research units and entire HEIs. It focuses specifically on the assessment of ORD practices, for which a comprehensive overview is lacking thus far. The analysis was conducted in four phases.

First, we identified initiatives and projects aimed at reforming research assessment across various academic levels and disciplines. We employed targeted keywords (e.g. “open data assessment”, “open research data + research assessment”, “research evaluation”, “ORD”) across both public and scientific databases (such as Zenodo, Google Scholar, Web of Science, ScienceDirect) for finding initiatives, projects, and frameworks on ORD applied to research assessment. We conducted a search for academic references concerning resources that have contributed to integrating open science into research assessment. We also exchanged insights among participants of the recORD project. We examined websites of main initiatives (e.g., DORA and CoARA; see section 3.2), which often led us to relevant resources analysed in this document. Additionally, we followed social networks frequented by professionals in research management and assessment, attending some of their webinars on research assessment. This phase, executed between mid-January and mid-February 2024, enabled us to compile a

comprehensive corpus of resources, including peer-reviewed articles, reports, and information on websites, forming the foundation for subsequent analysis.

Second, we proceeded to the selection of resources worth analysing in detail. To accomplish this, we specifically targeted resources adopting an ORD perspective, or more generally an open science perspective. We identified these resources based on the topics addressed within the documents, retaining those that engage with practices associated with keywords such as “open data”, “open research data”, “open science”, “sharing”, “dissemination”, “dataset” and “FAIR”. This selection process allowed us to make a first statement on the type of the resources identified. While there is an abundant scientific literature on the misuse and bias inherent in bibliometrics (e.g., Butler, 2010; de Vries et al., 2018; Gingras, 2016; Stephan et al., 2017) and peer review (Lee et al., 2013), the discourse on overcoming these challenges through novel research assessment frameworks including ORD is still in its nascent stages. Current efforts to incorporate ORD into research assessment practices are primarily discussed in opinion papers and reports emanating from various projects and initiatives dedicated to creating new frameworks.

Thus, in a third phase, we classified the documents into three types of resources and analysed how ORD is considered. The resources were either:

- ORD-relevant research assessment initiatives and projects (mobilised in section 3)
- ORD-relevant research assessment frameworks (mobilised in section 4)
- ORD-relevant research assessment peer-review articles and opinion papers (mobilised in sections 3 and 5)

In the third section of this review, we start with the presentation of international initiatives that have catalysed momentum within the research assessment reform movement. We present the values advocated by these initiatives, delineating their impact on shaping the course of reform endeavours. In the fourth section, we analyse a selection of diverse frameworks that integrate ORD practices or that might be good candidates for ORD integration. In the fifth section, we reflect how ORD is considered in the resources mobilised and make some propositions for a better recognition of ORD.

### **3 International and Swiss initiatives for reforming research assessment and ORD recognition**

This section describes the current context of reforming research assessment by examining the pivotal role played by international and Swiss initiatives. First, it highlights some shortcomings of traditional assessment methods, which prompted the creation of several international initiatives. After presenting key international initiatives, it explores how these initiatives integrate open science and ORD and provides an overview of the Swiss context and initiatives. Finally, it presents the core values promoted by these initiatives as they glean valuable insights for the development of responsible assessment practices, particularly concerning ORD.

#### **3.1 *Negative effects of traditional research assessment practices on research outcomes***

In recent years, the question of how scholars, and research in general, should be assessed and valorised has garnered significant attention within the academic field. The emergence of what Burrows (2012) termed “quantified control” in assessing performance, primarily through a range of metrics, such as citation counts and other quantitative criteria, has sparked debates regarding its efficiency and implication. While the adoption of quantitative measures for research assessment provides a sense of objectivity, it also produces a performative impact that can lead to inadequate and biased judgement of scientific material (Benedictus et al., 2016; McKiernan et al., 2019). The perceived importance and legitimacy of these metrics makes research assessment prone to be evaluated through a narrow perspective – i.e., measuring research outputs only with *h-index* or *impact-factors* of journals, to the detriment of other, more diverse, meaningful achievements or alternative indicators for the advancement of science but less rewarded by evaluators – a bias called *Campbell’s law* (Hatch & Schmidt, 2020).

Additional biases may arise from the misuse of bibliometrics, such as the inclination to cite highly cited references solely due to their popularity rather than their objective quality, thereby perpetuating a cumulative advantage for certain scholars. This practice can lead to disproportionate funding allocation, further exacerbating disparities in scholarly recognition and support – the Matthew effect (Merton, 1968).<sup>1</sup> The importance given to bibliometrics influences not only the type of scientific output but also the way science and scientific careers

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<sup>1</sup> For more examples of bias in using bibliometrics, see Hatch & Schmidt (2020) and Aubert Bonn & Bouter (2023).

are produced, promoted, and financed (Dahler-Larsen, 2014). In a scientific context where quantitative measures of research have an oversized impact and are falsely perceived as proxies of quality (Paulus et al., 2018), HEI and scholars may be inclined to prioritise rewarded research activities while neglecting crucial advancements for the scientific community and society at large. Research on research evaluation distinguishes between different types of evaluative metrics' effects on knowledge production (for an overview see de Rijcke et al., 2016). The first is goal displacement, i.e., that researchers focus on scoring high on a few indicators instead of doing good research and academic work or that they focus on producing quantity rather than quality or pick topics that lead to more citations or can be published in high-impact journals; the second is bias against interdisciplinarity, e.g., (disciplinary) journal lists can lead to dis-incentivisation to engage in interdisciplinary exchange; the third type is task reduction, i.e., research focus only on a specific type of publication type, namely journal articles indexed in the major citation databases, neglecting all other tasks relevant to academic work, such as communications to the public, teaching, academic self-administration, policy work, interactions with economy etc. One aspect of those neglected tasks are open data practices (Aubert Bonn et al., 2021). The review focuses on the latter.

In response, across countries, numerous initiatives have emerged over the past decade, aiming to propel reforms in research assessment beyond the confines of mainstream bibliometrics. These initiatives have facilitated the launch of transnational networks of individuals and organisations working at establishing new research assessment frameworks. Within these new frameworks, certain ones have integrated open research data to varying extents. The analysis focuses on these frameworks (see section 4).

### ***3.2 Main international initiatives to reform research assessment***

The push for reform in research assessment was propelled by several international initiatives, which cultivated networks of stakeholders dedicated to devising innovative approaches for evaluating research outputs. Within this array of initiatives, five international endeavours have significantly paved the path for advancing the reform of research assessment (table 1). Some initiatives have offered a comprehensive critical analysis of mainstream metrics (The Leiden Manifesto for research metrics, Metric Tide). Others have elaborated on basic principles the reform should be based on (DORA, Hong Kong Principles, CoARA). These initiatives advocate for recognising the diverse outputs, practices, and activities that (re)define the quality of scientific production. Beyond assessing the quality of scientific production itself, these

initiatives also emphasise considering how research is produced, addressing issues such as gender equality, inclusiveness, ethics, and integrity practices (UNESCO, 2021).

**Table 1.** Five main international initiatives to reform research assessment

Initiative	Year	Description
<a href="#"><u><i>The San Francisco Declaration on Research Assessment (DORA)</i></u></a>	2012	DORA is both a statement of principles and an organisation that campaigns for a reform of research evaluations practices. Published in 2013, the statement has been signed by more than 3000 organisations as of the end of early 2024. DORA collects resources on reforming research assessment, such as frameworks or case studies, all available on their website (Cagan, 2013)
<a href="#"><u><i>The Leiden Manifesto for research metrics</i></u></a>	2015	This manifesto, published in 2015 in <i>Nature</i> , consists of ten principles to combat misuse of bibliometrics in research assessment, in particular h-index, impact factor, and altmetrics (Hicks et al., 2015).
<a href="#"><u><i>The Metric Tide</i></u></a>	2015	The Metric Tide is a report published in 2015 that reviews the use of metrics across different disciplines in research management and assessment, in the UK and internationally, and formulate recommendations (Wilsdon et al., 2015).
<a href="#"><u><i>The Hong Kong Principles</i></u></a>	2020	The Hong Kong Principles consist of five principles developed in 2020 during the 6 <sup>th</sup> World Conference on Research Integrity and published as an academic essay. The third principle concerns specifically the reward of open science, and explicitly mentions research data (Moher et al., 2020).
<a href="#"><u><i>Coalition for Advancing Research Assessment (CoARA)</i></u></a>	2022	Launched by the European Commission and Science Europe, CoARA is a coalition of research performing and funding organisations, mostly from Europe, engaged in reforming research assessment. The coalition was created to assure the implementation of the <i>Agreement on Reforming Research Assessment</i> based on 10 principles (CoARA, 2022). Particularly active since its creation, COARA provides practical tools to facilitate the development of new research assessment frameworks based on qualitative evaluation. Its working groups, comprising members from various universities, focus on specific reform aspects.

Source: Developed by the authors.

Open science and ORD practices present a new lens through which research assessment can be executed, emphasising the consideration of a broader spectrum of research outputs and the means to evaluate them. However, the above-mentioned initiatives diversely underscore the importance of enabling and valorising open science in research assessment. In the last decade, there has been a gradual integration of open science into research assessment. The development

of research assessment reform and open science has progressed concurrently, with a recent convergence and, even more recently, a notable emphasis on ORD.

The assessment of open science was initially overlooked in major initiatives (DORA, the Leiden Manifesto for research metrics, and Metric Tide). More recent initiatives include open science: one of the Hong Kong Principles focuses exclusively on open science and CoARA mentions open science in diverse places. The increasing focus on open science also aligns with the push from transnational institutions, such as the Council of the European Union, urging member states to accelerate the development of indicators for open science (European Research Area and Innovation Committee [ERAC], 2021).

While at first open science assessment was centred mainly on open access in publication, assessing ORD practices is gaining traction within initiatives advancing open science (e.g., UNESCO Recommendation on Open Science, developed in 2021) and dedicated projects (e.g., FAIRer, GraspOS, and OPUS). Although these projects result in the proposition of specific frameworks to assess open science and ORD (see section 4), the initiatives provide general principles and values that should guide the development of new research assessment, such as ORD practices assessment (see section 3.4). The next section presents Swiss initiatives on reforming research assessment, which, like international initiatives, did not specifically address open science or ORD.

### **3.3 *Research assessment in Switzerland*<sup>2</sup>**

In Switzerland, CoARA impacts research assessment as swissuniversities and the SNSF have both signed the agreement in 2022 and are thus engaged in reforming research assessment within Swiss universities. As of February 2024, more than 600 organisations around the world – including universities, research centres, institutes, regional and national authorities – have signed this document and became CoARA members, including 11 Swiss HEIs.<sup>3</sup> However,

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<sup>2</sup> This section was developed by our FORS colleague Michael Ochsner.

<sup>3</sup> The Swiss higher education institutions that have joined CoARA (as of February 2024): University of Teacher Education, State of Vaud (HEP Vaud), Schwyz University of Teacher Education (PHSZ), Zurich University of Teacher Education (PHZH), University of Lausanne (UNIL), University of Geneva (UNIGE), University of Zurich (UZH), University of Fribourg (UNIFR), Federal Institute of Technology Zurich (ETH Zurich), University of Applied Sciences and Arts of Western Switzerland (HES-SO), Bern University of Applied Sciences (BFH), Zurich University of Applied Sciences (ZHAW).

diverse Swiss institutions have been active over the last decades to discuss and reform research assessment.

Switzerland has never adopted a unified research assessment framework like other countries, such as the Research Excellence Framework (REF) in the United Kingdom or the Standard Evaluation Protocol in the Netherlands (for an overview of national assessment systems in Europe, see Ochsner & Peruginelli, 2022). Given the federal structure of Switzerland, and thus the federal governance of higher education, most HEIs are governed under cantonal laws, while only the two federal institutes of technology in Lausanne and Zurich are governed under the federal level. However, in 2015, the Federal Act on Funding and Coordination of the Swiss Higher Education Sector (HEdA) combined all HEIs (i.e., the federal institutes of technology, the universities, the universities of applied sciences, and the universities of teacher education) under one roof organisation, *swissuniversities*, and included the explicit requirement to evaluate research on the institutional level. Still, almost each HEI has its own evaluation procedure (Ochsner et al., 2023), which is also linked to the main political idea that each institution has its specific mission, and that evaluation should reflect this mission that was published as “Swiss way to quality” by the former rectors’ conference in 2008 (Rectors’ Conference of the Swiss Universities [CRUS], 2008, as cited in Loprieno et al., 2016). The idea to not reduce academic research to publishing articles in some selected journals but to link evaluation to the actual tasks of academia in society has been reiterated by several policy papers of Swiss higher education stakeholders (Hasgall et al., 2018; Swiss Academy of Humanities and Social Sciences, 2012; Swiss Science and Technology Council, 2013; Swiss Science Council, 2018).

Nevertheless, given that the main organisation of evaluation procedures in Switzerland is institution- and discipline-specific, and that research has an international component, disciplines are rather oriented to their international evaluation norms than to the Swiss requirements. In some disciplines, like chemistry, physics or medicine, evaluative bibliometrics have been the standard. Furthermore, with the increasing availability of indicators due to digitalisation, there has been a strong push to evaluative bibliometrics in the beginning of the 2000s, which has put disciplines that do not have a tradition of bibliometric evaluation, such as the social sciences and humanities, under pressure. A *swissuniversities* project on *Research performances in the humanities and social sciences* therefore explored in two funding cycles from 2008 to 2013 and from 2013 to 2015 the opportunities and limitations of evaluative

bibliometrics and alternatives for it (Hasgall et al., 2018; Loprieno et al., 2016). The reports of this project concluded that there are numerous conceptual and methodological issues involved and that there are serious risks for negative steering effects on knowledge production (Hasgall et al., 2018; Loprieno et al., 2016). The results of the project have been met with great international and national interest, also beyond the social sciences and humanities disciplines.

The visibility of many Swiss initiatives in the international literature is limited, which is often due to misclassification and misinterpretation of authors that Switzerland would have “no” evaluation system (see, e.g., for societal impact evaluation, Bandola-Gill et al., 2021) or to the fact that Switzerland is excluded because it has no centralised evaluation system (Geuna & Martin, 2003; Hicks, 2012). Still, on the international policy level, the Swiss way to evaluation has been followed closely – e.g. in the League of European Research Universities (LERU) and the European Research Council that invited project members to workshops or policy meetings. This is because Switzerland already has experience with responsible research assessment and was active among policy stakeholders. For example, the Swiss Academy of Humanities and Social Sciences were active members of the COST Action European Network for Research Evaluation in the Social Sciences and Humanities (ENRESSH), that was co-initiator of the Helsinki Initiative for Multilingualism<sup>4</sup> and published several policy papers on responsible research assessment (ENRESSH, 2016; Ochsner et al., 2020). It is also a member of the policy organisation European Alliance for the Social Sciences and Humanities. The SNSF is active in exploring new assessment methods such as lotteries, Bayesian ranking or narrative CVs (see e.g., Heyard et al., 2022). Therefore, Switzerland has implemented and defended, at least on a high-stake level, many of CoARA’s principles years ago and can be considered among the forerunners of bottom-up approaches to research assessment.

### ***3.4 Core values of responsible research assessment and their links to ORD***

The various initiatives and projects aimed at reforming research assessment advocate for responsible research assessment grounded in core values that should serve as guiding principles when adopting new assessment criteria and processes (CoARA, 2022; Mustajoki et al., 2021). According to Curry et al., responsible research assessment should “incentivise, reflect, and reward the plural characteristics of high-quality research, in support of diverse and inclusive research cultures” (2022:4). Additionally, the FAIReR project emphasises that a responsible

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<sup>4</sup> Website of the initiative: <https://www.helsinki-initiative.org>



assessment should stem from anti-discrimination and equality regulations, as well as ethical guidelines for conducting research and evaluation responsibly (Mustajoki et al., 2021).

The most prevalent values mentioned in these resources are *quality and impact*, *diversity*, *equity*, *transparency*, and *adaptability*. While these sources primarily address values in the context of research assessment, we extend the discussion to encompass their relevance for assessing ORD practices when appropriate, drawing from our expertise in data archiving and management. Linking the core values with ORD is a novelty in the literature. This will be further elaborated on in section 5.

### 3.4.1 *Quality and impact*

Research assessment should prioritise the quality of scholarly contributions, encompassing both the process and outcomes of research. It should also evaluate how research advances knowledge (i.e., scientific and societal relevance) and assess its (potential) impact, whether scientific or beyond (CoARA, 2022). To effectively assess quality and impact, the Leiden Manifesto (Hicks et al., 2015), the Metric Tide (Wilsdon et al., 2015) and CoARA (2022) emphasise the importance of prioritising qualitative assessment, especially conducted by peers. They suggest that qualitative assessment can be supported by a responsible use of quantitative indicators when appropriate.

Open science, through making research methods and results available for review, verification, and reproducibility and granting access to research findings to society, contributes to research quality (CoARA 2022, EU 2021, UNESCO 2021). Planning to share data and making them open often increases the quality of the data, for example by better documenting them and asking for appropriate consent. In that way, ORD contributes to better data allowing for more robust scientific insights. In the ORD context, we believe that both the quality of the data and their relevance for research and future reuse could be assessed. Quality encompasses transparent data collection and sharing practices, necessitating comprehensive documentation throughout the data life cycle to facilitate accurate data reuse. The FAIReR project (Mustajoki et al., 2021) notably stresses that the production of high-quality ORD relies on the use of the FAIR principles (Findable, Accessible, Interoperable, and Reusable), elaborated by Wilkinson et al. in 2014.

### 3.4.2 *Diversity*

According to the reforming research assessment initiatives (CoARA, 2022; ERAC, 2021; Moher et al., 2020; Wilsdon et al., 2015) and open science projects (Mustajoki et al., 2021; UNESCO 2021), diversity should be understood in several ways. First, research assessment should acknowledge the multiplicity contributions, activities, and roles of researchers, as well as the diverse array of research outputs and impacts. Second, it should consider disciplinary differences, institutional contexts, and the varied career paths, ensuring that evaluations are sensitive to unique circumstances and challenges. In this respect, assessments of researchers should also be tailored to suit different career stages, and avoid potential bias and disadvantage-causing factors in assessments. Third, research assessments should incorporate a range of indicators and involve a panel of reviewers representing various backgrounds to mitigate biases and ensure inclusivity.

In recognising the value of diversity within ORD, research assessment should encompass all activities related to ORD. For example, this includes data collection and preparation to facilitate the sharing of well-documented and high-quality data in a FAIR manner, as well as efforts such as training and mentoring researchers in ORD practices. Additionally, it is important to acknowledge that practices and standards related to data collection, sharing, discovery, access, and reuse vary both across and within disciplines.

### 3.4.3 *Equity*

Research assessment must prioritise equity and fairness, ensuring that all researchers are evaluated based on the quality and impact of their work rather than extraneous factors such as personal characteristics (e.g., gender, sexual orientation, racial/ethnic origin, socio-economic status, and disability), research orientation, career stage, or institutional affiliations. Equity-based assessment practices promote diversity and inclusion within the research communities. This value is thus closely related to diversity.

The literature does not specifically address ORD, however, prior studies have shown that specific socio-demographic groups (e.g., early career researchers, women, individuals with a migration background) are much more often carrying out data cleaning and production tasks that are currently undervalued (Pownall et al., 2021; Rideau, 2021). In this respect, accounting for all ORD-related activities can improve gender and cultural diversity in academic research.

Additionally, the UNESCO Recommendation on Open Science stresses that open science and ORD “play a significant role in ensuring equity among researchers from developed and developing countries, enabling equitable and reciprocal sharing of scientific inputs and outputs and equal access to scientific knowledge regardless of location, nationality, race, age, gender, income, socio-economic circumstances, career stage, discipline, language, religion, disability, ethnicity or migratory status, or any other grounds” (UNESCO, 2021, p. 17).

#### 3.4.4 *Transparency*

Transparency plays a crucial role in ensuring the fairness of the assessment process, fostering trust among stakeholders, upholding the integrity of assessments, and ensuring accountability (ERAC, 2021). Key components of transparency include making assessment objectives, criteria, methods (such as materials and indicators), information used, outcomes, and decisions openly accessible to all involved parties, and ideally, publicly available (Mustajoki et al., 2021; Cagan, 2013; Hatch & Schmidt, 2020). However, when assessing individuals, it is essential to strike a balance between transparency and researchers’ privacy. Transparency in the information collected allows those being evaluated to verify and comprehend the results (Wilsdon et al., 2015). To support this, CoARA (2022) suggests implementing applicant right-to-reply procedures and open (non-anonymous) reviewing. Furthermore, CoARA (2022) underscores the importance of raising awareness and offering guidance and training on assessment criteria and processes. ERAC (2021) even specifies that researchers can be assessed only if they have received proper training or have been given the opportunity to undergo training.

As for research assessment, transparency through documenting the data collection and preparation phases enhances trust in the data (Moher et al. 2020; UNESCO 2021). Ultimately, this transparency also reinforces data quality. Furthermore, “publishing all research completely and transparently, regardless of the results, should be rewarded” (Moher et al., 2018). This includes in particular null-results and the avoidance of practices such as HARKing (hypothesizing after the results are known) and p-hacking (adjusting the analysis or defining the analysed sample until a statistically significant result is found) (Lindsay et al., 2016; Simonsohn et al., 2014).

### 3.4.5 *Adaptability*

Research assessment should be viewed as an iterative process that evolves and is adapted over time (Hatch and Schmidt 2020; Wilsdon et al., 2015). Continuous improvement involves regular evaluation and refinement of assessment criteria and processes to address emerging challenges, incorporate feedback, and adjust to changes in research environments; for example, aligning with evolving research standards and integrity as well as technical developments. Implementation and adjustment of research assessment should be done in collaboration with research communities that include a diversity of researcher profiles (COARA, 2022; Mustajoki et al., 2021). Moreover, ERAC (2021) suggests fostering inclusiveness and collective involvement in (re)designing research assessment to incorporate a variety of perspectives.

Assessing ORD practices involves recognising their evolving nature and adapting assessment approaches accordingly. Continuous monitoring and refinement of assessment is important to ensure its relevance and validity as ORD practices evolve. This proactive approach also helps identify and mitigate potential negative consequences, therefore promoting responsible assessment.

## **4 Research assessment frameworks recognising ORD practices**

Driven by various initiatives advocating for reform in research assessment, numerous projects have surfaced with the aim of conceptualising new frameworks for evaluating researchers, research units, and/or research proposals. In this section, we will describe and analyse eight projects that, from an ORD-practices perspective, have implemented a new research assessment framework. The selection of these projects is not exhaustive but is based on a qualitative evaluation of frameworks that recognise ORD practices in a concrete way or that might be good candidates for ORD integration. The selected frameworks fulfil two key criteria: (1) they either conceptualise ORD criteria in a manner that is observable and identifiable by evaluators, prompting questions on how to integrate ORD into a broader responsible research assessment dynamic or they offer an ORD-friendly framework that could be used for further recognition; and (2) they offer diverse perspectives on conceptualising an ORD-compatible framework, ranging from highly structured matrixes to those allowing greater flexibility in implementation, all with a qualitative lens. Given the scope of the recORD project on ORD,

frameworks that do not explicitly refer to ORD – or at least research data – have been excluded from the below analysis.

#### 4.1 *Open Science Career Assessment Matrix (OS-CAM)*

In 2017, the European Commission, engaged in promoting the principles of open science, promoted the *Open Science Career Assessment Matrix (OS-CAM)*, which has laid the foundations for the reform of research assessment with an open science perspective (O’Carroll et al., 2017), and is the basis of further frameworks (e.g., see NOR-CAM in section 4.2). The measure of “science openness” in this framework encompasses six key areas: *research outputs, research process, services and leadership, research impact, teaching and supervision, and professional experience*. Each of these areas offers potential evaluation criteria regarding open science practices. Most of these criteria primarily assess individuals’ practices and thus serve for recruitment and career assessment. Table 2 showcases the possible evaluation criteria for assessing open science practices in each key area.

**Table 2.** Open Science Career Evaluation Matrix (OS-CAM)

	<b>Areas</b>	<b>Possible evaluation criteria</b>
Research outputs	Research activity	- Pushing forward the boundaries of open science as a research topic
	Publications	- Publishing in open access journals - Self-archiving in open-access repositories
	Datasets and research results	- Using FAIR data principles - Adopting quality standards in open data management and open datasets - Making use of open data from other researchers
	Open source	- Using open tools/software - Developing open tools/software
	Funding	- Securing funding for open science activities
Research process	Stakeholder engagement	- Actively engaging society and research users in the research process - Sharing provisional research results with stakeholders through open platforms - Involving stakeholders in peer review processes
	Collaboration and interdisciplinarity	- Widening participation in research through open collaborative projects - Engaging in team science through diverse cross-disciplinary teams

	Research integrity	<ul style="list-style-type: none"> <li>- Being aware of the ethical and legal issues relating to data sharing, confidentiality, attribution and environmental impact of open science activities</li> <li>- Fully recognising the contribution of others in research projects, including collaborators, co-authors, citizens, open data providers</li> </ul>
	Risk management	<ul style="list-style-type: none"> <li>- Taking into account of the risks involved in open science</li> </ul>
Service and leadership	Leadership	<ul style="list-style-type: none"> <li>- Developing a vision and strategy on how to integrate open science practices in the normal practice of doing research</li> <li>- Driving policy and practice in open science</li> <li>- Being a role model in practicing open science</li> </ul>
	Academic standing	<ul style="list-style-type: none"> <li>- Developing an international or national profile for open science activities</li> <li>- Contributing as editor or advisor for open science journals or bodies</li> </ul>
	Peer review	<ul style="list-style-type: none"> <li>- Contributing to open peer review processes</li> <li>- Examining or assessing open research</li> </ul>
	Networking	<ul style="list-style-type: none"> <li>- Participating in national and international networks relating to open science</li> </ul>
Research impact	Communication and dissemination	<ul style="list-style-type: none"> <li>- Participating in public engagement activities</li> <li>- Sharing research results through non-academic dissemination channels</li> <li>- Translating research into a language suitable for public understanding</li> </ul>
	IP (patents)	<ul style="list-style-type: none"> <li>- Being knowledgeable on the legal and ethical issues relating to intellectual property rights</li> <li>- Transferring IP to the wider economy</li> </ul>
	Social impact	<ul style="list-style-type: none"> <li>- Evidence of use of research by societal groups</li> <li>- Recognition from societal groups or for societal activities</li> </ul>
	Knowledge exchange	<ul style="list-style-type: none"> <li>- Exchange in open innovation with partners beyond academia</li> </ul>
Teaching and supervision	Teaching	<ul style="list-style-type: none"> <li>- Training other researchers in open science principles and methods</li> <li>- Developing curricula and programs in open science methods, including open science data management</li> <li>- Raising awareness and understanding in open science in undergraduate and master's programs</li> </ul>
	Mentoring	<ul style="list-style-type: none"> <li>- Mentoring and encouraging others in developing their open science capabilities</li> </ul>
	Supervision	<ul style="list-style-type: none"> <li>- Support early-career researchers to adopt open science approach</li> </ul>
Professional experience	Continuing professional development	<ul style="list-style-type: none"> <li>- Investing in own professional development to build open science capabilities</li> </ul>
	Project management	<ul style="list-style-type: none"> <li>- Successfully delivering open science projects involving diverse research teams</li> </ul>
	Personal qualities	<ul style="list-style-type: none"> <li>- Demonstrating the personal qualities to engage society and research users with open science</li> <li>- Showing the flexibility and perseverance to respond to the challenge of conducting open science</li> </ul>

Source: O'Carroll et al., 2017.

While the matrix was initially designed to evaluate open science practices broadly, rather than exclusively focusing on ORD practices, some of the evaluation criteria can be tailored to ORD across areas. For example, the criteria “securing funding for open science activities” in the research outputs area can be interpreted for ORD as “securing funding for ORD activities”. Such activities could for instance, be, “data management” or “documentation activities to prepare data sharing”. Other criteria in the matrix are already adapted to ORD, such as recognising “self-archiving in open-access repositories” or “using FAIR data principles”.

This framework offers the potential to consider ORD not only as a research output, but puts forward that it should be assessed across six main areas. This approach is consistent with the value of “diversity” described in section 3. It is based on the principle of broadening the spectrum of research evaluation. Here, besides being a research output (1), ORD is also assessed throughout the entire research project process (2), as a service provided to the specific scientific community (3), as an impact on a wider audience (4), as a theme for teaching and supervision (5), and ultimately as an investment in terms of professional experiences (6). Therefore, ORD might be conceptualised not merely as a particular type of activity (e.g., archiving data) but as something more embedded in the full scientific process and approach. This framework allows also for sufficient adaptability in determining the criteria to be utilised from a wide array of options.

The **multidimensionality of ORD practices** is a key element that could be further developed within this framework. We argue that all reflections on integrating ORD practices should be grounded in this notion of implementing ORD practices beyond solely evaluating research outputs.

#### **4.2 Norwegian Career Assessment Matrix (NOR-CAM)**

Universities Norway<sup>5</sup> (UHR) has supported a project since 2021 aiming at developing a new matrix to evaluate research activities. It is based on 6 principles: *quality*, defined as a balance between quantitative and qualitative measure; considerations of the *diversity* of career paths; *open science* as a fundamental principle; *transparency*; *gender balance*; *local* design of assessment processes at institutional and research unit level (UHR, 2021). The matrix is a further development of the OS-CAM matrix presented above. It is intended for three types of

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<sup>5</sup> UHR is a cooperative body and interest organisation for 32 accredited universities and in Norway. It has a similar role as swissuniversities in Switzerland.

research assessments: the assessment of researchers by academic institutions; the assessment of applicants of research proposals by funders; and the assessment of Norwegian research and education at an institutional level by national authorities.

Table 3 presents the NOR-CAM matrix. Similar to the OS-CAM matrix, the NOR-CAM matrix is also built on 6 key areas, referred to as “areas of competencies”. While there are minor changes, these 6 key areas are very close to the ones of the OS-CAM matrix. Nevertheless, each of these areas is now completed by new columns. The first two columns outline the proposed six areas of competencies and provide examples of “results and competencies” that could be assessed. The proposed “results and competencies” are not accurate enough to constitute ready-to-use indicators of ORD practices but they do provide information about the type of outputs that could be assessed. The third column refers to the places where systematic documentation should be provided for the assessment of each area of competencies. The fourth and final column provides a subjective interpretation of each area of competency.

This last column, left to the applicant’s own reflection on their various activities, is one of the main innovations of NOR-CAM compared with to OS-CAM. UHR argues that this fourth column allows the applicant or unit being evaluated to give a subjective assessment of their own results and competencies. The assessment committee can then compare the subjective interpretations of each area of competency by the researchers or units and the documents provided objectifying those competencies. This creates a balance between the more quantitative measures of column three and the applicant’s qualitative narratives.

**Table 3.** The NOR-CAM matrix

<b>1. Area of competence</b>	<b>2. Results and competencies (examples)</b>	<b>3. Documentation</b>	<b>4. Reflection</b>
A. Research output	<ul style="list-style-type: none"> <li>– Published works</li> <li>– Datasets</li> <li>– Software</li> <li>– Methodologies</li> <li>– Artistic results</li> <li>– Research reports</li> </ul>	CRIS systems (e.g., Cristin) and other databases	<p>Reflection on the relevance and quality of the results.</p> <p>Emphasis is placed on open access to published works and other results, as well as on whether the data adhere to the FAIR principles.</p>



B. Research process	<ul style="list-style-type: none"> <li>–Leadership and participation in research groups</li> <li>–Working across disciplines</li> <li>–Research integrity/RRI</li> <li>–Editorial activity</li> <li>–Peer reviews</li> <li>–Building consortia</li> <li>–External funding</li> <li>–Development of research infrastructure</li> <li>–Leadership and participation in clinical trials</li> </ul>	CRIS* systems and other databases. Narrative CV system with links to source data	Reflection on roles and relevance. How and why various actors within and outside academia have been involved in the research process. Emphasis is placed on transparency in the research process.
C. Pedagogical competence	<ul style="list-style-type: none"> <li>–Planning, execution, evaluation and development of lectures and supervision of students</li> <li>–Participation in the development of educational standards in academic communities</li> <li>–Mentoring</li> <li>–Devising and sharing learning materials</li> </ul>	CV system with links to source data. Institutional registration of lecturing activity. Pedagogical portfolio.	Reflection on formal and informal competence and experience. Emphasis is placed on open education and the sharing of educational resources.
D. Impact and innovation	<ul style="list-style-type: none"> <li>–Innovation</li> <li>–Entrepreneurship and commercialisation</li> <li>–Social innovation</li> <li>–Innovation in the public sector</li> <li>–Citizen science</li> <li>–Textbooks</li> <li>–Publishing activity</li> <li>–Research reports and studies</li> <li>–Application of research in public administration and industry</li> </ul>	CRIS systems and other databases. Altmetrics. Narratives and impact stories. Patents and licences.	Reflection on the relevance and effects of activities for society, as well as external contributions to research. Sharing of research and educational results with the general public and others.
E. Leadership	<ul style="list-style-type: none"> <li>–Institutional and departmental leadership</li> <li>–Leadership in academic networks and projects</li> <li>–Leadership outside academia</li> <li>–Leadership in panels and other committee work</li> </ul>	CV system with links to source data, CRIS systems and other databases, narratives.	Formal and informal leadership, reflection on roles, processes and effects. Contribution to strategies and policy development in relation to open science.
F. Other experience	<ul style="list-style-type: none"> <li>–Experience and competence from sectors outside academia</li> <li>–Courses and discipline-related development work.</li> </ul>	CV system with links to source data.	Reflection on how these experiences contribute to the competency in general.

Source: UHR, 2021: 20-21.

This reflection column introduces a **narrative perspective** into research assessments, which is arguably an important addition for enhancing the quality of an evaluation. Applied to ORD, the

narrative perspective provides individuals undergoing assessment with the opportunity to reflect on and highlight their ORD practices. Moreover, it offers a means for qualitatively evaluating of ORD, adapted to the specificities of each researcher and thus aligns with the value of “equity” (see section 3). For instance, a junior scholar who has not yet had the opportunity to publish FAIR datasets, should not be evaluated in the same manner as a senior researcher with a more extensive track record on demonstrating quantitative performance of ORD. In such cases, the narrative perspective provides an alternative approach to assessing ORD practices for the junior scholar.

### ***4.3 The two-step assessment procedure of the German Psychological Society (DGP)***

In 2022, a task force established by the German Psychological Society (DGP) introduced a new two-step procedure for research assessment (Schönbrodt et al., 2022). This framework is based on a two-step procedure that combines objective measures and qualitative assessment.<sup>6</sup> It is intended to be used for hiring researchers and professors.

In a first step, the authors propose a negative selection for evaluating the longlist of candidates. In an “algorithmic manner”, they recommend employing an indicator-based evaluation and selection to establish a threshold with minimal requirements for candidates to qualify for the shortlist. They suggest that all applicants passing the threshold should be qualified for the shortlist, rather than selecting only “the best” candidates. “This way, minor variations in score will not unfairly disqualify applicants that are good enough” (Schönbrodt et al., 2022: 5). While they argue that the assessment of candidates should consider five areas of academic contributions (*research, teaching, leadership, services, societal impact*), they emphasise that the initial phase should primarily focus on evaluating the research dimension, perceived as the most important one. Figure 1 illustrates the five areas of academic contributions, with a particular emphasis on research.

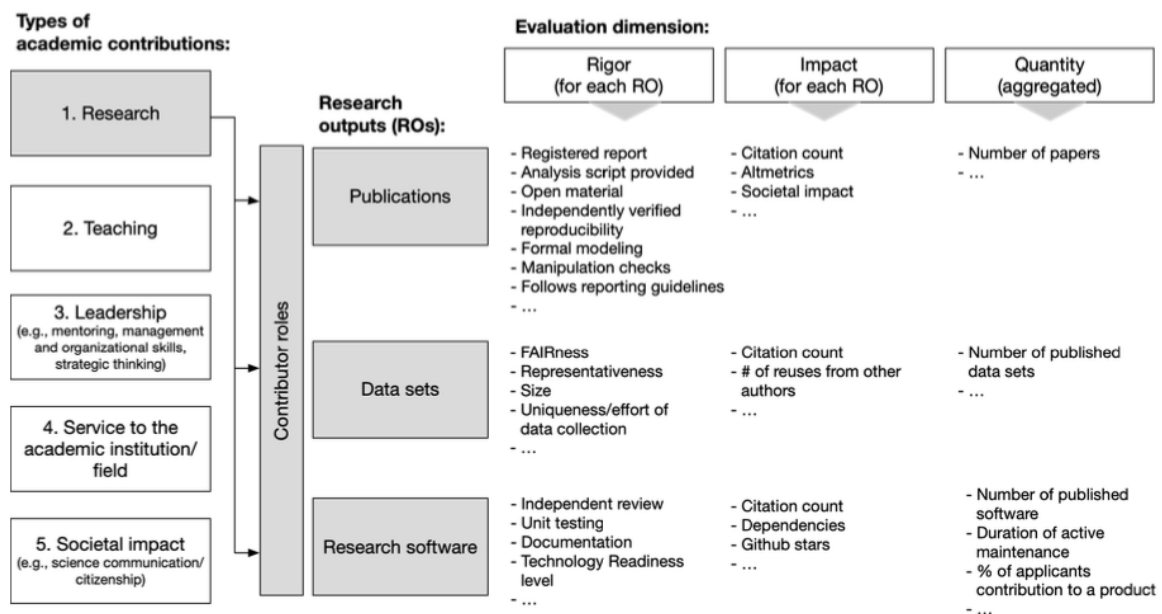
The five types of academic contributions are very similar to the areas of competences seen in the OS-CAM and NOR-CAM frameworks. Within the “research contribution”, they conceptualised three research outputs that should be assessed: *publications, datasets* and *research software*. The output “datasets” concerns ORD practices. Contrary to the multidimensional aspect of OS-CAM or NOR-CAM, ORD practices are accounted for only in

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<sup>6</sup> For a complete discussion on how this new assessment can be implemented, see Gärtner et al., 2022.

the research contribution in this approach, at least in a formalised way. Published datasets are evaluated with three dimensions: the *rigor* measures if an activity has been skilfully executed (in this example: the production of datasets); the *impact* measures if an activity has an impact within the academic field (in this example: one possible measure is the reuse of the data); and the *quantity* measures the volume of an activity (in this example: one possible measure is the number of datasets published by the candidate). The indicators for each of these three evaluation dimensions are not extensively formalised. ORD criteria are slightly developed but they stay rather evasive. Nevertheless, this triple dimension of the evaluation (rigor, impact and quantity) constitutes an interesting evaluation strategy for quantitative metrics.

**Figure 1.** The five types of academic contributions according to the DGP with a focus on research



Source: Schönbrodt et al., 2022:4.

In a second step, once recruiters have compiled a shortlist of candidates, the authors suggest that quantitative metrics should not play a significant role anymore, giving way to qualitative analysis of all five of the academic contributions. This second phase is based on an in-depth discussion about how innovative and meaningful the activities of the candidates are. However, the authors do not elaborate extensively on the conduct and evaluations of the interviews, nor do they address the incorporation of ORD into the evaluation process.

While this approach does not elaborate on multidimensional integration criteria for ORD as other frameworks such as OR-CAM or NOR-CAM do, it is worth noting the **two-step approach**: employing quantitative metrics for ORD as initial screening, followed by

qualitative evaluation through interviews as a subsequent assessment phase. Such an approach should be discussed: how to combine the two steps? How much importance should be given to each? For instance, employing quantitative criteria for ORD evaluation poses varying challenges across disciplines. In some disciplines, sharing datasets might be easier, while others would benefit from a more qualitative approach – as long as the evaluation method remains transparent.

#### **4.4 LERU Framework for the Assessment of Researchers**

In 2022, the *League of European Research Universities* (LERU), a network of 23 universities in 12 countries around Europe (including two Swiss universities: Geneva and Zurich), published a position paper presenting a framework for the assessment of researchers (Overlaet, 2022). LERU's framework builds on the recognition that scientific careers must be assessed with a multidimensional perspective. In this sense, it aligns with the frameworks analysed above, acknowledging that scientific careers must be diverse in terms of profiles and contributions. It recognises five basic dimensions: *research, education, public engagement and outreach, service to the institution, and other*. The proposed dimensions are close to the ones already identified with OS-CAM, NOR-CAM, and the two-step assessment procedure of DGP. While Overlaet (2022) posits that LERU framework is in line with the open science movement, it does not specifically elaborate on ORD. The descriptions of the five dimensions remain general and do not propose a concrete implementation.

Despite this lack of elaboration of ORD, LERU's framework presents an interesting reflection on research assessment. The five basic dimensions all centre around achievements. The author suggests moving beyond a narrow focus on achievements with a “transition from a performance perspective” (Overlaet, 2022: 18) to a new approach also considering the developmental and the contextual perspectives. While assessing performance and achievements remains essential, reforming research assessment should not be confined by this paradigm. For instance, top performance “should no longer be an excuse for bad leadership or lack of collaboration” (Overlaet, 2022: 20). According to Overlaet (2022), the “developmental perspective” should consider evaluating the personal development of researchers, such as the quality of leadership (e.g., vision of future research, role model, research integrity, and ethics), the potential of a researcher to collaborate, and their level of (potential) innovation. Furthermore, since research occurs within specific contexts, absolute methods for assessing performance or achievements

should be avoided in favour of a “contextual perspective”, which focuses on professional and personal contexts.

Going beyond multidimensional evaluations based on performance and achievement is crucial for discussions on integrating ORD practices into research assessment. Specifically, the **contextual perspective** is essential for ORD. It emphasises the need for evaluators to tailor their integration of ORD according to the context in which the evaluated individual works. This includes considering if research is produced in an institutional context enabling open science, and more specifically ORD – for instance, organisations endowed with infrastructures and policies for ORD.

#### **4.5    *The Open and Universal Science (OPUS) framework***

The OPUS project, funded by the European Union, is an ongoing project aimed at reforming research assessment towards a system that incentivises, and rewards open science practices. They conducted a literature review on how open science is related to five dimensions: *incentives and rewards, precarity of research careers, gender equality, industry practices, and trust* (Huntingford et al., 2023). Currently, OPUS develops indicators and metrics to monitor open science practices.

A first draft of a research assessment framework to assess researchers at an individual level was published in 2024 (O’Neill, 2024). The framework is structured around four main categories of activities: *research, education, leadership, and valorisation*. Each of these categories of activities are divided into subcategories, which each have a set of potential indicators (see table 4). The four categories of activities of the framework are in line with the previously presented frameworks (OS-CAM, NOR-CAM, two-step assessment procedure of DGP).

**Table 4.** OPUS Framework

<b>Category of activities</b>	<b>Subcategories</b>	<b>Indicator groups</b>
Research	Proposals	Proposal development
	Methods	Methods development
	Data	Data planning
		Data management
		Data review
	Software	Software development
		Software review
Publications	Publications drafting	
	Publications review	
Education	Materials	Materials development
	Courses	Courses development
	Resources	Resources development
	Teaching	Student teaching
	Supervision	Student supervision
	Skills	Skills development
Leadership	People	Staff supervision
	Projects	Project management
	Organisation	Unit management
	Recognition	Expert positions
Valorisation	Communication	Public writing
		Public speaking
	Engagement	Intersectoral engagement
		Citizen engagement
Innovation	Research exploitation	

Source: O’Neill, 2024.

The indicator groups for each subcategory consist of three types of indicators “defining the lifecycle of an activity” (O’Neill, 2024: 9), showing similarities with the indicators of the two-step assessment procedure of DGP. The three types of indicators are:

- *Process*: assessing activity which is in development or is ongoing
- *Output*: assessing activity that reached an endpoint
- *Outcome*: assessing a result of an activity

The authors of the framework have elaborated a list of quantitative metrics for each one of these three types of indicators (O’Neill, 2024). A set of these quantitative metrics has been

developed specifically for ORD practices. Table 5 displays these indicators. These metrics concern the subcategory “data” within the category of activity “Research”, as seen in table 4. ORD practices are mentioned only within this subcategory and are thus rather not conceptualised with a multidimensional perspective.

**Table 5.** Indicators for ORD practices developed by OPUS

<b>Indicator group</b>	<b>Indicator type</b>	<b>Quantitative metric</b>
Data Planning	Process	# of (FAIR) data management plans being developed
	Output	# of (FAIR) data management plan finalised
	Outcome	# of (FAIR) data management plan implemented
Data Management	Process	# of (FAIR) data sets being developed
	Output	# of (FAIR) data sets finalised
		# of (FAIR) data sets archived
	Outcome	# of (FAIR) data sets accessed
# of (FAIR) data sets cited		
Data Review	Process	# of (FAIR) data set peer reviews being drafted
	Output	# of (FAIR) data set peer reviews submitted
	Outcome	# of (FAIR) data set peer reviews accepted

Source: O’Neill, 2024.

While this framework is still under development, it presents a compelling array of indicators relevant to the recORD project. Yet, it is important to notice its heavy reliance on quantitative metrics, which aligns closely with the conventional way of assessing scientific “excellence”, such as in mainstream traditional assessment frameworks based on publication metrics. Rather than fundamentally reforming research assessment, it expands the spectrum of metrics. When introducing this framework OPUS (O’Neill, 2024: 23) asserts that “it combines quantitative and qualitative approach to assessment, whereby the framework is based on quantitative metrics that are always necessarily accompanied by qualitative descriptions”. However, the qualitative dimension appears somewhat marginalised, reduced to mere “descriptions” of quantitative metrics.

While the qualitative dimension is less elaborated in this framework, its development of **quantitative metrics** is noteworthy. At this stage of recognising ORD practices, there is still no consensus on the quantitative criteria to be used for evaluating ORD. This framework helps formalise a set of basic quantitative metrics.

#### 4.6 *HI-FRAME: A qualitative assessment of open science*

An interesting qualitative approach was developed at the University of Zurich, between 2021 and 2023, in the form of a project entitled HI-FRAME<sup>7</sup>. Aimed to anchor open science practices in hiring processes at the University of Zurich, this project developed a tailor-made and flexible framework that systematically incorporates open science activities into the evaluation of candidates in professional hiring. Unlike some frameworks previously analysed that are based on a matrix, the project HI-FRAME developed a qualitative approach in the form of a set of questions. The catalogue of questions was built to address all main areas of academic activity from an open science perspective (Gilland Lutz & Falub, 2023). Seven questions, each of them addressing a specific aspect of open science, have been created. Each of these questions invites candidates to reflect on how open science influences a specific dimension of their work. Authors also provide examples of expected answers by the candidates. Table 6 shows the questions and a selection of expected answers that could fit into ORD criteria. The hiring committee decides which questions should be used in the hiring process and the form of the reply (written answers or oral answers during interviews). In this sense, it is a framework of questions that is highly adaptable to specific contexts as suggested by other frameworks such as LERU's framework or SCOPE (described below).

**Table 6.** HI-FRAME: open science related questions and potential answers

Areas	Question	Examples of answers
Research	How have Open Science practices enhanced the quality or impact of your own work as a researcher in the last five years?	<ul style="list-style-type: none"> <li>- Sharing FAIR data</li> <li>- Sharing code/tools/software</li> <li>- Sharing negative results</li> </ul>
Teaching & learning	How have Open Science practices enhanced the quality or impact of your own work as an educator in the last five years?	<ul style="list-style-type: none"> <li>- Train and support early-career researchers in open science practices</li> <li>- Development of educational resources on open science</li> </ul>
Academic culture	How have Open Science practices contributed to an inclusive and stimulating environment?	<ul style="list-style-type: none"> <li>- Recognising the contributions within the team that promotes open science</li> </ul>
Service to the university	How have Open Science practices enhanced the quality or impact of your service to your university in the last five years?	<ul style="list-style-type: none"> <li>- Being part of working groups charged with developing open science practices</li> <li>- Supporting/organising scientific initiatives with shared data with the general public</li> </ul>

<sup>7</sup> Website of the project: [https://www.gleichstellung.uzh.ch/de/projekte/hi\\_frame.html](https://www.gleichstellung.uzh.ch/de/projekte/hi_frame.html)



Clinical activities	How have Open Science practices enhanced the quality or impact of your work as a clinician in the last five years?	- Any example given in the other questions in a clinical context
Support for early-career	How have Open Science practices enhanced the quality or impact of your support for early-career researchers in the last five years?	- Organisation of open science trainings - Integration of open science practices into PhD supervision
Impact	How have Open Science practices enhanced the quality or impact of your work in terms of its contribution to society?	- Communication or educational initiatives - Advisory for government agencies

Source: Gilland Lutz & Falub, 2023.

The set of questions of HI-FRAME is interesting in that it deviates from being a matrix-based framework, as the ones considered previously. Matrix-based frameworks might lack elaboration on how to integrate the qualitative dimension of the assessment. This set of questions offers a better conceptualisation of how **interviews** can be used for ORD assessment.

#### 4.7 *The SCOPE framework*

The SCOPE framework, developed in 2019 by the International Network of Research Management Societies (INORMS), is a guide for university leaders, helping them to adopt principles of responsible research assessment (Himanen et al., 2023). Notably distinct from the preceding frameworks, which focus on providing a standardized solution for assessing research, SCOPE does not offer an already-built solution. It could rather be described as a conceptual tool facilitating the development of a new research assessment framework. It proposes to create a research assessment framework through five stages.

SCOPE is guided by three main principles:

- *Evaluate only where necessary.* The authors argue that over-evaluation is problematic, even when it is not done through a narrow perspective, and it includes a broader diversity of contributions. “A new focus on open research practices, integrity and collegiality in our assessments doesn’t displace or even dilute a focus on publications and grant income, but simply expands the number of dimensions on which researchers are assessed” (Himanen et al., 2023:6). The SCOPE framework asks evaluators whether they need to evaluate at all, or whether an alternative approach might be taken (e.g., enabling ORD by offering the good infrastructures rather than evaluating it).
- *Evaluate with the evaluated.* A new assessment framework should be co-designed with the groups of individuals or organisations being evaluated.

- *Draw on evaluation expertise.* Researchers often engage in evaluating research proposals and applicants, which might lead them to assume that they possess the necessary skills for designing research assessment frameworks. However, the authors argue that developing research assessment frameworks is the domain of specialists in this field. Just as academic research relies on the expertise of researchers, research assessment should similarly rely on the expertise of evaluation professionals.

The SCOPE framework is a participatory approach to research evaluation based on the five stages shown in table 7.

**Table 7.** The five stages of the SCOPE framework

Stage	Description
START <i>Start with what you value</i>	The first stage consists in identifying the core values to the research or entity evaluated. What is important to be evaluated for the stakeholders involved rather than relying on the available indicators?
CONTEXT <i>Consider the context</i>	The second stage consists in understanding the organisational setting (e.g., size, discipline, location, the population evaluated) and the reasons for evaluation. It focuses on identifying contextual factors in order to have an appropriate evaluation and avoid a “one model fitting all types of contexts” solution.
OPTIONS <i>Options for evaluating</i>	The third stage encourages exploration of all available options for evaluating and advocates for their equal consideration. This entails embracing both quantitative and qualitative approaches tailored for specific contexts, while acknowledging the inherent limitations of each. We recommend drawing inspiration from existing initiatives and research assessment frameworks, like the ones mentioned earlier. However, it is imperative to ensure that the selected options are specifically tailored to the unique needs of the respective HEIs.
PROBE <i>Probe deeply</i>	The fourth stage consists in asking four questions: Who might the chosen approach discriminate against? How might this approach be gamed? What might the unintended consequences be? Does the cost of measuring outweigh the benefit?
EVALUATE <i>Evaluate your evaluation</i>	The final stage involves evaluating the effectiveness and impact of the evaluation itself. Did the evaluation meet its aim? Did the evaluation cause any unintended consequences?

Source: Himanen et al., 2023.

The SCOPE approach has been implemented by some research institutions, notably in the UK (Davies & Fadhel, 2023) and Finland (University of Turku, 2023). The five stages are conceptualised at a level of abstraction, allowing for their application to more specific aspects of research assessment, including ORD. The questions addressed in each stage should be integral to the reflections made by research management teams involved in evaluating ORD practices. One interesting perspective offered by SCOPE is to avoid what is referred to as “**one**

**model fitting all types of contexts” solutions** and rather build tailor-made solutions through workshops (see examples of SCOPE workshops in Himanen et al., 2023).

#### 4.8 *The Open Science Assessment Framework (OSAF)*

The Open Science Assessment Framework (OSAF) is currently being developed by the project GraspOS, funded by the European Union (Tatum et al., 2023). The aim of this framework is to facilitate research assessment with an open science perspective. OSAF is composed of three elements: the *SCOPE+I method*, the *Assessment Portfolios*, and the *Assessment Registry*.

The first element is the SCOPE approach as described above, augmented by the inclusion of the letter “I” for *Infrastructures*. This expansion accounts for the infrastructural requirements essential to the implementation of the four stages of the SCOPE framework.

According to this revised approach, the assessment is divided into four phases (see Table 8):

1. *Assessment readiness*. This is the phase in which the purpose and the context of the evaluation must be defined. It corresponds to the two first phases of the SCOPE framework (START and CONTEXT phases).
2. *Assessment design*. This is the phase in which the options of the assessment are chosen and tested. It corresponds to the third and fourth phases of the SCOPE framework (OPTIONS and PROBE phases).
3. *Assessment execution*. This is the practical phase in which the assessment is performed.
4. *Assessment evaluation & dissemination*. This is the final phase in which the evaluation guidelines are evaluated and disseminated. It corresponds to the final phase of the SCOPE framework (EVALUATE phase).

**Table 8.** Open Science Assessment Framework (OSAF)

Assessment event phases	SCOPE	SCOPE+i Method	Assessment Infrastructure
Assessment readiness	1 Start with what you value 2 Context & purpose	<ul style="list-style-type: none"> <li>– OS assessment guidelines</li> <li>– Assessment team guidelines</li> <li>– Template, assessment readiness</li> <li>– Template, stakeholder mapping</li> <li>– Template, purpose statement</li> <li>– Template, contextual factors</li> </ul>	Assessment Portfolio <ul style="list-style-type: none"> <li>– Assessment team</li> <li>– readiness report</li> <li>– Stakeholder map</li> <li>– Value statement</li> <li>– Purpose statement</li> <li>– Relevant contextual factors</li> </ul>
Assessment design	3 Options for evaluation 4 Probe deeply	<ul style="list-style-type: none"> <li>– Translating values, purpose and context into assessment protocol</li> <li>– Narrative template</li> <li>– Strategy template</li> <li>– Evaluator guide</li> <li>– RRA obstacles guide</li> <li>– Diversity of OS contribution guides</li> <li>– Equity, diversity, inclusion guide</li> <li>– Responsible assessment checklist</li> <li>– Assessment protocol guide/template</li> <li>– indicator toolbox guidelines</li> <li>– open research information sources</li> <li>– GraspOS services catalogue</li> </ul>	Assessment Portfolio <ul style="list-style-type: none"> <li>– Collaborative evidence selection</li> <li>– Evaluand(s) narrative</li> <li>– Indicators and data sources</li> <li>– Assessment protocol document</li> </ul>
Assessment execution		–	Assessment Portfolio <ul style="list-style-type: none"> <li>– Distribute portfolio to stakeholders</li> </ul>
Assessment evaluation & dissemination	5 Evaluate the evaluation	– Evaluate the evaluation guidelines	Assessment Portfolio <ul style="list-style-type: none"> <li>– Assessment team</li> <li>– Readiness report</li> <li>– Stakeholder map</li> <li>– Value statement</li> </ul>

Source: Tatum et al., 2023.

The *Infrastructure* dimension is present in every phase and comprises two key elements: the *Assessment Portfolio* and the *Assessment Registry*. The *Assessment Portfolio* encompasses all necessary resources for conducting assessments, such as readiness reports, value statements, relevant contextual factors, indicators, data sources and assessment protocols. Conversely, the *Assessment Registry* involves compiling registered assessments protocols to inspire other groups in designing new assessment approaches. The incorporation of this transversal dimension is noteworthy for the recORD project, since it underscores the importance of considering the necessity for **infrastructures** for assessment production.

## 5 Insights into the assessment of ORD practices and propositions

In the selected frameworks, the recognition of ORD practices takes various forms. This section aims to provide an overall analysis and discussion of the frameworks outlined in section 4. It intends to discern consensus or disagreements within the frameworks, identify good practices, highlight challenges, and specify areas for improvement or action across the three assessment levels of the recORD project: research proposals, researchers, and research units and institutions. This discussion is informed by both the literature and the authors' expertise in social science research data management and archive and is structured around values described in section 3. Observing the current assessment of ORD practices through these values raise central questions and critical observations. This analysis derives to the formulation of **preliminary propositions** that serve as general guidelines for the project's next steps. They should be further discussed in the upcoming recORD workshops, which will involve diverse profiles and additional perspectives, with the aim to derive concrete recommendations.

### 5.1 *Quality and impact*

As discussed in section 3, in reforming research assessment initiatives, the values of quality and impact refer to three main aspects: firstly, the quality of science, encompassing both the research process and its outcomes; secondly, the broader impact of research, extending beyond scientific realms; and thirdly, the significance of qualitative assessment by peers, complemented by quantitative indicators. We start by discussing this last aspect regarding ORD assessment by qualitative and quantitative approaches (5.1.1), as this discussion is relevant to delve into the assessment of research data quality (5.1.2) and impact (5.1.3).

#### 5.1.1 *Finding the right balance between qualitative and quantitative approaches to ORD assessment*

Compared to traditional forms of assessment, initiatives to reform research assessment place greater emphasis on qualitative assessment, with quantitative metrics serving to complement or validate qualitative findings. This strategic approach aims to mitigate biases inherent in traditional research assessment. CoARA (2022) stipulates that quantitative indicators should be limited and used only when they are appropriate. Similarly, the Leiden Manifesto suggests that quantitative indicators should support a qualitative assessment and not the other way around (Hicks et al., 2015).

Yet, frameworks currently used or being developed do not always elaborate explicitly on how such a qualitative approach should be implemented. While resources presenting frameworks recognise that figures and measurable information must be “used with caution” (Hyrkkänen et al., 2023: 86), they often do not propose further development on how to balance these two approaches, nor how to implement a qualitative approach. The OS-CAM framework presentation emphasises the significance of “qualitative judgement” by evaluators, yet it lacks clarity on the specific process for making such judgements (O’Carroll et al., 2017:6). NOR-CAM introduces a narrative perspective, allowing individuals under assessment to communicate about their scientific achievements. The two-step assessment procedure of DGP employs a blend of quantitative and qualitative indicators. HI-Frame is the only framework focusing exclusively on a qualitative approach of open science with interviews.

Selecting and using indicators to assess ORD practices meaningfully poses a significant challenge. Determining when and how to integrate quantitative and qualitative assessment approaches adds another layer of complexity. The literature offers different insights to guide the selection and use of both quantitative and qualitative approaches effectively, which are briefly described below and can be summarised in a first proposition.

**Proposition 1: Consider assessment levels and metrics pitfalls when selecting ORD-related indicators**

**A) Considering the assessment level**

A method of selecting or prioritising assessment approaches is to consider the level of assessment (e.g., individual [including research proposal], unit, institution, country). Hyrkkänen et al. (2023) argue that assessment has greater consequences for researchers than institutions. At the individual level, special attention should thus be paid to the responsible use of metrics to support peer-review assessment. Similarly, Helmer et al. (2020) suggest that quantitative assessment should not supplant qualitative approaches and peer-review assessment. Thus, while quantitative metrics for ORD practices are interesting indicators, they should not be used as the main or only indicators of an assessment, mimicking the publication metrics criticised by the initiatives on reforming research assessment. Following Glänzel (2015), the balance between qualitative (peer evaluation) and quantitative (metrics) methods varies depending on the assessment level. While a more qualitative approach is preferred for individuals, a more quantitative approach may be suitable for units or institutions. Furthermore,

we would like to emphasise that assessments comparing the same entity (or individual) over time should be distinct from those comparing different entities (or individuals). In the latter scenario, reliance on quantitative indicators for assessment should be approached cautiously, with careful consideration of disciplinary and career disparities (see section 5.2).

## **B) Mitigating the risk of metrics-only excellence assessment**

The selection of evaluation criteria for ORD should be approached with caution to avoid replicating the same issues that initially prompted the reform movement in research assessment. The assessment of researchers and research proposals through the lens of the notion of “excellence” has been both a guiding principle and a source of bias within academia (Gingras, 2016) and manipulation (Falagas and Alexiou, 2008). As criticised by the main reform assessment initiatives (Cagan, 2013; Hicks et al., 2015, CoARA, 2022), scientific excellence has often only been measured in research assessment frameworks through quantitative research outputs such as publications and citations of research articles. The initiatives outlined in this review aim to diverge from this narrow perspective of excellence, advocating for a more comprehensive and qualitative evaluation of research endeavours. However, there is a potential pitfall in transitioning from an ideology of excellence centred on journal publications and citation metrics to a new paradigm of excellence grounded in ORD practices or, more broadly, on open science. The pursuit of excellence has elevated metrics such as impact factors or h-index to disproportionate importance. It is imperative that responsible research assessment frameworks and the assessment approaches they suggest assessing ORD practices do not perpetuate this trend by introducing new imbalanced ORD measures, generating new inequalities and disproportions. This risk could manifest in a fixation on “quantity over quality”, where individuals and research groups strive to generate artificially numerous datasets shared in open repositories merely to fulfil numerical quotas, without prioritising the FAIR principles nor considering genuine societal and scientific impact of the shared data. Thus, as mentioned by Glänzel & Wouters (2013: 4), performance, including ORD performance, should not be “reduce[d] to single numbers”. In a recent study, Bordignon et al. (2023) recognise that the use of a narrative CV can prevent the misuse of metrics and a narrow definition of impact, favouring a broader range of research contributions.

### **C) Navigating standardisation challenges**

Standardisation is essential to enable comparisons. In assessment, comparisons are needed whether between candidates or yearly performance evaluations of research units, for example. Quantitative approaches, like metrics, are typically viewed as offering this standardisation, while qualitative methods are often perceived as hampered by subjectivity and lack of uniformity. Quantitative approaches and indicators are indeed more frequently discussed and integrated into the presented frameworks.

The standardisation offered by quantitative indicators is particularly evident in traditional assessment metrics, such as the number of articles published or the journals' impact factor, which facilitate comparisons. However, such comparisons are not yet applicable to ORD-related indicators, such as the number of published datasets (to account for data sharing), the number of views and downloads of datasets or metadata (to account for general data usage), and the number of citations of datasets (to account for academic data usage) (see Table 9). For instance, the lack of standardised counting methods for data usage across research data repositories hinders comparability (Lowenberg et al., 2019). Additionally, variations in data sharing practices, where one research project may consolidate all data into one dataset while another may distribute data across multiple datasets, further complicate assessment. Furthermore, formal data citation practices remain limited and under-used within the research community across scientific disciplines (Bornatici & Fedrigo 2023; Late & Kekäläinen, 2020; Parsons et al., 2019; Vannan et al., 2020; Yoon et al., 2019; Zhao et al., 2018; Zuiderwijk et al., 2020), and when data citations are provided in an article, this information is often lost along the publication process by indexing services (Lowenberg et al., 2019). To address this lack of standardisation and evaluate researchers' ORD practices, a qualitative approach could involve asking whether scholars shared their research data or reused data whenever possible and relevant, or whether they formally cited primary and secondary data in their articles or research proposals (Bornatici & Fedrigo, 2023). This approach could similarly be applied to research proposals assessment. For instance, does the team intend to reuse or share data when suitable, or is there counterarguments.



**Table 9.** Examples of qualitative and quantitative assessment approaches of ORD at each assessment level

	<b>Qualitative (or mixed) assessment of ORD</b>	<b>Quantitative assessment of ORD</b>
<b>Research proposals</b>	<ul style="list-style-type: none"> <li>• Self-assessment portfolios (e.g., DMPs)</li> <li>• Impact stories or case narratives</li> </ul>	<ul style="list-style-type: none"> <li>• Data sharing (intended)</li> <li>• Secondary data reuse</li> </ul>
<b>Researchers</b>	<ul style="list-style-type: none"> <li>• Narrative CV</li> <li>• Self-assessment portfolios (e.g., Openness Profile)</li> </ul>	<ul style="list-style-type: none"> <li>• Data sharing</li> <li>• Data usage</li> <li>• Data citations</li> <li>• Secondary data reuse</li> </ul>
<b>Research units and institutions</b>	<ul style="list-style-type: none"> <li>• Self-assessment portfolios</li> <li>• Impact stories or case narratives</li> </ul>	<ul style="list-style-type: none"> <li>• Data sharing</li> <li>• Data usage</li> <li>• Data citations</li> <li>• Secondary data reuse</li> </ul>

Source: Developed by the authors.

On the other hand, qualitative assessment methods are evolving to introduce standardisation in certain aspects. The use of narrative CVs or self-assessment portfolios improve input and structure of qualitative information in assessments (Hyrkkänen et al., 2023). Indeed, at the researcher level, individuals can provide information on their ORD practices in narrative CVs. A narrative CV is a résumé in a descriptive format, where researchers can present their most important scientific contributions in the form of short narratives rather than listing positions and publications in a metrics-based CV. Such CVs offer the possibility to increase visibility to research outputs other than publications, typically ORD practices. The SNSF has implemented this format in 2022. Beyond Switzerland, this tool has been applied in several universities, such as the *Résumé for Researchers* in the UK and is promoted by national funders, such as the Dutch research funder (NWO) or the Luxembourgish funder (FNR). Self-assessment portfolios also enable qualitative narratives on achievements, and they are applicable at each assessment level (see Hyrkkänen et al., 2023 for a review of portfolios). For research proposals, with regards to ORD, these self-assessment portfolios could take the form of Data Management Plans (DMPs), where research teams are requested to describe their data management and can justify open or restricted data sharing for example. In order to collect information on ORD practices, instructions and templates for narrative CVs or self-assessment portfolios should however explicitly invite users to provide information on their ORD practices.

Additionally, assessment tools offering a mixed approach can be interesting as quantitative information can be completed by free text, and vice versa. Commenting the quantitative measures is required by the OPUS framework (see section 4.5). Some narrative CVs, such as

the one developed by the SNSF, include the possibility to combine narratives with a limited number of research outputs (max. 10). The Openness Profile is another promising example of such mixed approach. As a user-curated portfolio, it allows researchers to include a narrative component to contextualise their work and to compile different types of contributions (drawn from the ORCID record, from the web, and descriptive text for contributions without URL) (see Murphy & Jones, 2020 and Jones & Murphy, 2021 for more information thereon).

Finally, it should be noted that whether using a quantitative or a qualitative assessment approach, fair assessment of the collected information should depend on the discipline, career stage, and context as more thoroughly explained in section 5.2.

### 5.1.2 *Assessing ORD quality*

ORD practices contribute to research quality, for instance by improving transparency and robustness of findings. The quality of the shared data, whether openly accessible or with some restrictions, can be assessed in terms of both their data management and documentation, ensuring accurate comprehension and reuse, and their relevance for research and future reuse (also referring to impact).

Data quality is considered by 3 out of 8 frameworks. OS-CAM, the two-step procedure of DGP and OPUS consider data quality and assess it through the lens of the FAIR principles (Wilkinson et al., 2016). For instance, within OS-CAM, the criterion “using FAIR data principles” is used to assess the quality of datasets. The two-step procedure of DGP utilises “FAIRness” as an indicator of dataset “rigor”, whereas the OPUS framework consistently considers that all data must adhere to FAIR principles. While this constitutes a good approach to evaluating data quality, the challenges associated with adopting the FAIR principles are often under-discussed. It seems necessary to address to what extent data can attain FAIR status.

**Proposition 2: Assess ORD quality through the FAIR principles, data curation, and data peer-reviewing**

Quantitative metrics such as number of datasets published, number of views or downloads of datasets and metadata, and, to a lesser extent, the number of data citations lose relevance if the data at hand is inaccurate, incomplete, or poorly documented, limiting its potential for reuse. The importance of quality data cannot be overstated. Nevertheless, the criteria for defining data

of “good” quality remains unclear (del Carmen Calatrava Moreno et al., 2019), making evaluation challenging.

One current approach is to evaluate data FAIRness as a proxy for quality, as observed in the presented frameworks. However, there is currently no standard approach for measuring the FAIRness of data, although numerous efforts are underway (Mustajoki et al. 2021, Huber et al. 2021). While the Findable, Accessible, and Interoperable aspects of FAIR primarily fall under the responsibility of the repository *where* the data are shared, Reusability depends on *how* the data are shared, including factors such as file formats, data management, and data documentation, and thus primarily falls under the data authors responsibility.

In general, research data repositories provide the organisational context for enabling FAIR data (L’Hours et al., 2022). From our perspective, an important approach to guarantee data quality is thus to share data through FAIR-certified repositories, although no formal certification currently exists. However, the FAIRsFAIR project (work package 4) has addressed the FAIR certification of repositories.<sup>8</sup> By comparing the requirements of the CoreTrustSeal certification (version 2.0) with FAIR principles, the project found that 9 out of 15 FAIR principles align with CoreTrustSeal requirements (L’Hours et al., 2022). It is noted that the 2025 review of CoreTrustSeal will enhance the integration of FAIR principles into their certification process.

Additionally, to guarantee the Reusability of the data, certain repositories offer high-quality data curation services, where data curators ensure that data are appropriately organised, described, and ready for reuse before publishing them (this also aligns with the CoreTrustSeal requirement R11 on data quality).<sup>9</sup> Data stewards within HEIs might also do this quality check before the submission of the data to a repository. To empower researchers to share FAIR data, HEIs should ensure that they provide or facilitate access to FAIR repositories and to high-quality data curation services, either internally or externally. Consequently, this could serve as criteria to assess research units and institutions (see table 10). More generally, ORD related assessment at the unit or institutional level should evaluate the institutional context: research institutions (and units) are responsible for building the conditions enabling researchers to have

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<sup>8</sup> Website of the project: <https://www.fairsfair.eu>

<sup>9</sup> “R11. The repository has appropriate expertise to address technical data and metadata quality and ensures that sufficient information is available for end users to make quality-related evaluations” (L’Hours et al., 2022:30).

FAIR ORD practices. This could be done through ORD guidelines and policies, trainings, infrastructures, and support services.

**Table 10.** Examples of indicators to assess research data quality and FAIRness at each assessment level

	<b>Qualitative (or mixed) assessment of ORD</b>	<b>Quantitative assessment of ORD</b>
<b>Research proposals</b>	<ul style="list-style-type: none"> <li>• Sharing data through FAIR repositories</li> </ul>	
<b>Researchers</b>	<ul style="list-style-type: none"> <li>• Practice/expertise in FAIR data management and documentation</li> <li>• Sharing data through FAIR repositories</li> </ul>	<ul style="list-style-type: none"> <li>• Number of FAIR datasets published</li> <li>• Number of peer-reviewed data published</li> </ul>
<b>Research units and institutions</b>	<ul style="list-style-type: none"> <li>• Offering trainings on FAIR data management and documentation</li> <li>• Offering FAIR data curation services</li> <li>• Offering FAIR repositories</li> </ul>	<ul style="list-style-type: none"> <li>• Number of FAIR datasets published</li> <li>• Number of peer-reviewed data published</li> </ul>

Source: Developed by the authors.

While data curators or data stewards can assess the quality of data sharing, they usually cannot evaluate the relevance of the data for research. This task should be undertaken by peer reviewers within the respective field. Currently, peer review of data is in its nascent stages and lacks standardisation (Lowenberg et al., 2019), albeit it is done for data articles.

Another approach to enhance ORD quality is to assess the data management process over the data life cycle, in addition to data sharing practices. This could be facilitated through a narrative approach, allowing researchers to describe their commitments to FAIR ORD practices, even in cases where actual number of data shared is limited or absent.

Finally, the scientific community, including researchers, data managers and stewards, data curators and repositories, and journals and editors should be engaged in the production of FAIR data. This ensures that metrics emphasised in research assessment frameworks include an evaluation of the quality of shared data.

### 5.1.3 *Assessing ORD impact*

Impact is a key aspect of research assessment in most frameworks. Explicitly addressed in OSCAM, NOR-CAM, HI-FRAME, the two-step procedure of DGP and OPUS, these frameworks do not directly address the assessment and measurement of academic and societal impact of ORD, with OPUS being an exception. In OPUS, impact is evaluated through indicators focusing on activity outcomes, relying mainly on quantitative metrics supported by descriptive

texts. Based on our expertise, we aim to discuss this practice and stimulate further reflection on the subject.

**Proposition 3: Be cautious when assessing ORD impact quantitatively**

Criticism of using quantitative metrics as proxies for research impact and excellence is evident in initiatives focused on reforming research assessment, as discussed in sections 3 and 5.1.1. Similarly, assessing the academic and broader impact of ORD through quantitative measures is challenging. One concern is the lack of standardisation among indicators, as outlined in section 5.1.1. In the next paragraphs, we elaborate on how quantifying impact based on the number of datasets shared (potentially leading to more views, downloads, and citations) is susceptible to manipulation and is influenced by multiple factors. Hence, their use should be approached with caution, especially when assessing researchers. Finally, we briefly discuss qualitative approaches.

Firstly, the nature of datasets themselves differs from one project to another, which makes comparisons and the assessment of impact based on counts of published data difficult and unfair. Indeed, a dataset might capture the full extent of longitudinal data files, while another one can include a single data file containing a few data points. Research teams may also spend varying amounts of time collecting, preparing, and documenting the data. Some might employ external data management services. One might also consider distinguishing between sharing complete data from a research project and sharing partial data for reproducibility purposes. While both are important open science practices, they yield different academic impacts.

Secondly, researchers sometimes share their data in multiple datasets (e.g., one interview or one wave of data collection per dataset), where joining all data files in a single dataset would enhance efficiency and reuse convenience. Currently, this may occur due to misunderstandings about what the best file structure for deposited data is. However, in the future, it could be intentionally done to inflate data publication counts, and subsequent views, downloads, and citations. In this context, data stewards and curators within HEIs and research data repositories have a key role to play in advising researchers on effective data organisation for the deposit. Ultimately, repositories, as the entities publishing the datasets, should verify that the organisation of data is convenient and efficient for reuse.

Thirdly, when utilising reuse metrics such as the number of views, downloads, or citations of a dataset, evaluators should consider temporality and disciplinary-specific factors. Regarding temporality, datasets may not be immediately reused but might have a significant impact in the future. The level of public and academic interest in one topic can change over time, influencing data access and reuse. Moreover, reuse practices can vary across disciplines and even within more specialised domains. It is crucial for employers and funders to acknowledge these disciplinary differences when developing and applying such metrics (see also section 5.2.2).

Fourthly, including different metrics, while accounting for their limitations, expands the scope of impact assessed. For example, certain forms of reuse, such as for teaching, policy applications, and outreach and engagement, may not always result in formal citation, but metadata views and dataset's downloads can provide insights into their reuse (Lowenberg et al., 2019). Moreover, dividing the number of views, downloads, and citations by the number of datasets shared, the time since sharing and the researcher's academic years could mitigate some of the limitations. However, some metrics used to measure research impact should be avoided, such as altmetrics (e.g., online mentions of research data in social media, blogs, or Wikipedia). These alternative quantitative indicators are in an early developmental stage (Thelwall et al., 2013; Mustajoki et al., 2021). Despite their inclusion in some frameworks, they are unreliable and non-transparent indicators (see e.g., Gumpenberger et al., 2016).

To complete quantitative approaches, qualitative approaches can also be used to describe the impact of ORD practices. Impact stories or impact case studies, used by the Research Excellence Framework (REF) in the UK, describe the importance and extent of impact attributed to research in general, but that can be adapted to specifically target ORD practices (Hyrkkänen et al., 2023). These impact case studies have been performed at the institution level but could be adapted for research proposals and researchers' assessment, for example, as a specific point of DMPs and narrative CVs.

## **5.2 *Diversity and equity***

The values of diversity and equity encompass acknowledging the diverse contributions, activities, and roles of researchers, and the range of research outputs and impacts they generate using diverse assessment indicators and processes (5.2.1). Moreover, an equitable assessment should consider diversity across disciplines (5.2.2), and diversity in academic careers (5.2.3), rather than assessing all research proposals, researchers, and research units equally.

### 5.2.1 *The multidimensional dimension of ORD practices*

ORD encompasses a wide range of activities. To mention a few, scholars can contribute to ORD by preparing data with documentation following the FAIR principles, offering trainings, mentoring or expertise on ORD. They also produce various research outputs, such as sharing FAIR datasets, creating DMPs, or writing syntax for reproducibility. This multidimensional dimension of ORD practices should be accounted in research assessment. Some frameworks, namely OPUS and the two-step assessment procedure of DGP, integrate ORD practices in a dedicated area of the assessment, such as “research output”, with a series of quantitative indicators, complemented with qualitative narratives. Others, such as OS-CAM, disseminate ORD practices throughout a broader range of areas, reflecting a more holistic integration. We argue that the latter perspective is a more compelling one.

#### **Proposition 4: Account for ORD practices beyond research outputs**

Research assessment reforms, such as the ones promoted by CoARA, stress the importance of promoting different types of careers in academia and valorising wider categories of scientific activities. Considering ORD practices in a more holistic integration offers the opportunity to assess research and researchers beyond an extension of traditional metrics – the traditional metrics being articles’ publications and citations count, extended here with published FAIR datasets count.

A first possibility would be to not focus exclusively on research outputs but also on the amount of effort put into applying ORD practices during a research project or for a research proposal, even though it does not translate ultimately into data sharing for various reasons (see 5.3.1). Another possibility would be to take into consideration other types of contributions, factors not valorised in academic careers such as preparing data for sharing and documenting them, sharing results and data with the general public, contribution to policy development on ORD, and reusing data for pedagogical purposes with students. Accounting for all ORD practices can improve diversity in academic research, acknowledging and valuing tasks performed by specific socio-demographic groups (Pownall et al., 2021; Rideau, 2021).

Expanding the spectrum also allows fairer assessment practices since, depending on career stages, certain individuals may not yet have extensive research outputs in terms of ORD even as, in their daily scientific practice, they may contribute to ORD through other activities. This

acknowledges that different career trajectories and roles within academia involve diverse forms of engagement with ORD. Table 11 gives an indication of possible contributions to ORD beyond research outputs.

**Table 11.** Potential contributions to ORD beyond research outputs

	<b>ORD practices beyond research outputs</b>
<b>Research proposals</b>	<ul style="list-style-type: none"> <li>• Integrating a vision and strategy on diverse ORD outputs and practices</li> <li>• Forming young researchers to ORD practices</li> <li>• Sharing ORD outputs with the general public</li> </ul>
<b>Researchers</b>	<ul style="list-style-type: none"> <li>• Data preparation and documentation for sharing</li> <li>• Mentoring/assessing ORD practices</li> <li>• Participating in national/international networks on ORD</li> <li>• Support early-stage researchers to adopt ORD</li> </ul>
<b>Research units and institutions</b>	<ul style="list-style-type: none"> <li>• Offering interactive tools for data sharing with a wider audience (e.g. website with statistic or visual generators)</li> <li>• Offering trainings in ORD</li> <li>• Engaging in recognition of ORD through active role and representation in international networks</li> </ul>

Source: Developed by the authors.

### 5.2.2 *The disciplinary differences in ORD assessment*

The discourse and terminology on open science and ORD are based on the practices of a few disciplines, such as natural and life science research (see e.g., Nederhof, 2006; Watchorn, 2022). However, what is understood as “data” and how “open” is defined influences strongly what falls under ORD practices (see van der Heyde, 2019; Watchorn, 2022). While some disciplines look back on more than forty or more years of ORD practices, such as comparative survey research or cross-national macro-economic research using country-specific indicators (Scheuch, 2003), other disciplines encounter ethical issues such as data protection despite efforts to share data (Corti, 2000). This led researchers from different disciplines to engage in linking research assessment to researchers’ tasks (for medicine, see e.g., Andersen, 2013; Bazeley, 2010; for social sciences and humanities, see e.g., Hemlin, 1993; Oancea & Furlong, 2007).

At a disciplinary level, assessing ORD in a single perspective could exacerbate existing inequalities, favouring disciplines inherently more conducive to data sharing than others. With disciplines reliant on restrictively defined data, like those employing quantitative analyses, data sharing is often easier. In contrast, disciplines employing qualitative research methods face unique challenges. In these disciplines, what might constitute “data” is interwoven with other types of information such as sketches, comments, and verbatims accounts. The field notes in



qualitative research typically contain a variety of information whose boundaries of what constitutes “data” are not always straightforward to discern (Levain et al., 2023). In a study on the effects of open science in ethnography, Khan et al. (2024) demonstrate that not all epistemic cultures benefit equally from ORD. The authors argue that it is crucial that individuals assessing academic careers and research proposals take into consideration the cultural differences that exist in data production and use. While the authors are supportive of the open science movement and are aligned with other scholars advocating for more data transparency in ethnography (Murphy et al., 2021), they argue that ethnographic data sometimes cannot be shared, particularly when it puts the population under study at risk, or it can be shared only with clear policies and restrictions. The way data is produced and structured – such as field notes – is not easily transferable into datasets, nor can it be reproduced in the same manner – as it is less about reproducing facts than interpreting data within a conceptual framework. This reality is not unique to ethnography and exists in other epistemic cultures, including studies on cancer and human subjects where data sharing is often challenging, and sometimes impossible (Piwowar, 2011).

**Proposition 5: Acknowledge disciplinary heterogeneities in ORD practices**

As argued by Kahn et al. (2024), ORD should not be implemented indiscriminately across scientific disciplines. Instead, adapted solutions tailored to specific epistemic cultures should be sought. The diversity of epistemic cultures and their respective approaches to scientific research should be preserved. ORD practices should not be conceptualised as a normative framework that fails to recognise this diversity. The application of ORD principles must be assessed according to the unique constraints and requirements of each discipline. In some cases, “open” does not imply unrestricted access to data, and limitations may apply. In other instances, reproducibility might be unattainable, and data sharing could raise legal and/or ethical concerns. Similarly, in some cases, notably in qualitative research in social sciences or in humanities, the definition of “data” might differ from other epistemic cultures. A promising avenue for further exploration of these differences between disciplines is to consider ORD practices in consultation with the stakeholders involved. By doing so, the aim is to address the diversity of epistemic cultures equitably, avoiding the unintentional reinforcement of scientific credibility disparities by overemphasising certain epistemic cultures at the expense of others.

### 5.2.3 *The differential ORD contexts of academic careers*

The possibilities of producing ORD practices vary significantly, not only depending on disciplinary disparities as highlighted earlier, but also on academic differences at individual, unit, and organisational levels. At an individual level, researchers should be assessed based on their academic age and what could reasonably be expected from them. The notion of “net academic age” is already used in Switzerland, particularly by the SNSF. It consists in assessing researchers not based on how long someone has been in academia, but rather the total time they have spent doing research. Unit-wise, substantial differences may exist in the ability to foster good ORD practices, irrespective of researchers’ motivations. Factors such as heavy scientific workloads, limited financial resources, inadequate infrastructure, and institutional support deficits may all contribute to these variations. At an organisational level, some institutions may provide superior infrastructural support and resources, encompassing research data repositories, open science policies, specialised trainings, and dedicated personnel like data stewards, data management specialists, and research managers. Disparities in infrastructures and resource levels can lead to cumulative advantages, not only for HEIs with the highest volumes of resources to produce open science and ORD practices, but also for scholars working in these privileged contexts (Mustajoki et al. 2021).

#### **Proposition 6: Ensure equitable ORD assessment of researchers**

When proposing new assessment, it seems important to consider the context in which research is being conducted, and to adapt assessment criteria accordingly. Following the SCOPE framework, reform in research assessment should move away from the idea of a “one model fitting all types of contexts” (Himanen et al., 2023) and practice an equitable evaluation of ORD that accounts for structural limitations and does not (re)produce academic and social inequalities.

Integrating qualitative assessment into the general evaluation process might be a possible way to achieve more equity. The narrative CV introduced by the SNSF in 2022 not only is based on the net academic age, but also promotes equal opportunities and increases the visibility and value given to outputs other than journal publications, particularly for researchers whose disciplines or research institutions may be at a disadvantage in the race to publish. Similarly, the narrative CV could be used to increase value given to ORD practices for researchers or

research institutions that might have structural disadvantages in their capacity to produce ORD captured with quantitative metrics.

However, it is important to note that qualitative assessments also have negative effects resulting from peer review, such as biased and conservative evaluations, lack of transparency, subjective preference given to certain achievements over others, or over rewarding researchers and research proposals involving renowned universities. Therefore, adopting a qualitative approach for more equity must be accompanied by a reflective process on how the evaluator produces a verdict. Moreover, one strategy to mitigate these limitations is to ensure diversity among reviewers.

### **5.3    *Transparency and adaptability***

From the evaluators' perspective, transparency implies open assessment processes, with all parties involved knowing the criteria, methods, information used, and the outcomes and decisions derived from the assessment. Adaptability, on the other hand, calls for actively monitoring and refining assessment practices and criteria to align with the changing context of academia and avoid potential negative consequences of assessment. Similarly, from the researchers' perspective, these two values are essential in conducting research. Transparency is a scientific requirement, guiding various research aspects (e.g., data collection, data analyses, authorship, researchers' potential conflict of interests). Meanwhile, adaptability ensures that research is conducted within a fitting institutional and legal framework. When applied to ORD, these values raise considerations for both the evaluators' and the researchers' perspectives. We would like to highlight two of these considerations. First, the joint responsibility of researchers and institutions in developing transparent and adapted solution for data sharing respecting legal and ethical issues (5.3.1). Second, the necessity to conceive ORD assessment as a transparent and iterative (5.3.2).

#### **5.3.1    *Questioning the responsibility of data sharing***

Researchers and research units should be aware of the different regulatory frameworks that apply to their field of research before publishing data. They should also consider ethical questions and ensure that their data protect the respondents' interests and have an adequate level of data protection, also in line with legal requirements (Diaz, 2019).

Beyond the assessment of publishing FAIR data in FAIR repositories, it is essential to question the extent to which data can be open and not simply assume that it can be. Adhering to the FAIR principles implies that the data should be accessible, but it does not necessarily mean publicly open. For various reasons, data might not be open to everyone in every circumstances. For example, national or discipline-specific policies might prevent certain data to be openly shared publicly. Ethical questions, such as the protection of the respondents' interests must also be addressed (Diaz, 2019; 2021). These considerations are crucial for ensuring responsible and ethical handling of data, as well as for promoting transparency and equity in data sharing practices. However, these questions are rather absent from the frameworks analysed, even though similar concerns have been addressed by others (Mustajoki et al., 2021).

**Proposition 7: Promote responsible sharing of ORD**

The incentive to publish datasets must not inadvertently sow the seeds of future legal or ethical problems stemming from inadequate data sharing strategies. We contend that recognising ORD in research assessment necessitates a thorough examination of the conditions and implications of data access, including considerations of privacy, consent, and potential harm. Prior to data sharing (or requiring researchers to share their data), researchers should consider: Which data can be shared? Who should be granted access to the data? What risks are associated with sharing particular data? Are there existing agreements (and constraints) for data sharing and data usage?

These questions should be addressed by researchers engaged in sharing their data, yet they may not be specialists of these issues. If ORD becomes an incentive in academic careers, then research performing organisations should provide the support services allowing these questions to be answered, notably in the form of specific training and legal and ethical guidance. Thus, broader reflections on data management, in particular ethics, informed consent, and access control, is necessary in order to promote data sharing in a responsible way (Heers, 2023). Overall, expertise and practices in responsible data sharing could be assessed at the researcher level, while units or institutions could be evaluated for their institutional support and infrastructure facilitating responsible data sharing practices.

### 5.3.2 *Transparent and adaptable assessment of ORD practices*

While transparency in both the research and assessment processes has been emphasised by NOR-CAM, adaptability was integrated into the frameworks in two distinct ways. Firstly, LERU and HI-FRAME underscore the importance of tailoring evaluations to suit the specific institutional context in which individuals work. Secondly, SCOPE, in line with CoARA, accentuates the necessity of assessing the effectiveness and impact of assessment, and advocates for the active involvement of the evaluated group, such as researchers, in the (re)definition of assessment criteria. In the next proposition, we posit that the research institution (or unit) bears the responsibility of implementing transparent and adaptable ORD assessments. Consequently, the way the institution (or unit) accomplishes this task should be incorporated into its assessment.

#### **Proposition 8: Guarantee transparent and iterative ORD assessment**

To establish a transparent ORD assessment, we advocate for research institutions to adopt public assessment policies encompassing ORD. Moreover, it is crucial that researchers and research units are duly informed about the integration of ORD into the assessment criteria, methods, and processes. While such transparent practices should be implemented at the institutional level, entities responsible for researchers' assessment could also contribute. Drawing from the HI-FRAME framework, which advocates that the assessment questions and methods, whether written or oral, employed during the hiring process should be predetermined and consistently applied to all candidates. While this systematic approach likely mitigates biases, such as implicit gender biases in interviews (Latu et al., 2015), this practice could also significantly enhance transparency with further steps. Specifically, disclosing in advance these assessment questions and methods to all candidates (or more generally to all evaluated entities) would promote transparency on the assessment process.

The research institutions (or units) are also responsible for including a process to monitor and regularly adapt their assessment practices, whether regarding ORD or more generally. Assessing ORD practices involves acknowledging the evolving nature of research data and the methods used for their collection, processing, and analysis. It is important to monitor and adapt assessment approaches to maintain their relevance and validity as ORD practices continue to evolve (Hatch and Schmidt 2020; Wilsdon et al., 2015). Moreover, by actively monitoring and refining assessment methods, potential negative consequences of evaluating ORD practices can

be identified and mitigated, thereby promoting a more responsible assessment of ORD practices. This proposition therefore targets more specifically the assessment processes of research proposals, researchers, and research units and institutions. Institutions (or units) are encouraged to establish transparent and iterative assessment processes, to be adopted by the entities responsible for assessment at these levels.

## **6 Conclusion**

Amongst academic stakeholders including funders and research managers, there is consensus that research assessment needs to be reformed. Recognising ORD plays a major role in these discussions. While ORD practices are increasingly recognised as research outputs, there is still a lack of established best practices for their evaluation and recognition. This holds internationally as well as for Switzerland.

This review has analysed eight frameworks for research assessment that include an ORD-dimension. These frameworks are useful for informing recORD in two ways: First, they allow us to capture the current knowledge base on ORD in research assessment. Second, they help us to define the next steps to be taken within the project. Three assessment levels are considered: namely, research proposals, researchers, and research units and institutions.

The review has shown that while there is consensus regarding a need for reform of research assessment, how to actually reform the status quo and how to implement change is extremely challenging and still in the development phase. Some but not all frameworks include and emphasise ORD; those that do, do so in various ways and to different extents. Given its embeddedness in the recORD project, this review has mainly included frameworks that clearly refer to ORD. In recORD, the underlying hypothesis is that research assessment in Switzerland should include ORD. How to implement recognition thereof remains fuzzy; especially, when the aim is to establish an approach across scientific disciplines.

The frameworks considered in this review are the Open Science Career Assessment Matrix (OS-CAM), the Norwegian Career Assessment Matrix (NOR-CAM), the two-step assessment procedure of the German Psychological Society (DGP), the LERU Framework for the Assessment of Researchers, the Open and Universal Science (OPUS) Framework, HI-FRAME, the SCOPE (Start, Context, Options, Probe, Evaluate) framework, and the Open Science

Assessment Framework (OSAF). HI-FRAME has been developed in Switzerland and is particularly interesting due to its purely qualitative approach. The frameworks have different origins, some are international, while the DGP one is community-based, and HI-FRAME is institutional. What is important with respect to Swiss context and well-reflected in the motivation for recORD is that the wish and need to include ORD in assessments comes from the institutions. While OS-CAM is higher level, but national groups of institutions (like recORD) have developed frameworks based on OS-CAM in Norway (NOR-CAM), Finland (Responsible Research Network) and Netherlands (The Dutch Recognition & Rewards Programme).

With its innovative methodology this review has gone beyond the existing literature on frameworks for reforming research assessment. In line with the recORD project, we have drawn on a sample of frameworks that explicitly refer to ORD. Moreover, this study has not only described the frameworks, as much of the previous literature did, but went deeper and identified underlying and guiding values. These values are quality, impact, diversity, equity, transparency, and adaptability. By aligning its actions with these values, recORD can ensure to not only focus on a change of metrics but to derive recommendations that enable and push for responsible research more generally. Overall, the frameworks, their approaches towards ORD, and potential impacts on reforming research assessment while recognising ORD are analysed at a much deeper level than in the previous literature. Explicitly linking the core values with ORD is a novelty in the literature. Thereby this review makes an important step forward in integrating ORD in responsible research assessment. Future research and projects could follow the model developed in this review and apply it to dimensions of research assessment that are different from ORD.

An important conclusion is that there is not a single framework that recORD could take as such and suggest its implementation across the Swiss academic landscape. The task for recORD is now to take the most suitable elements from each framework and construct a consistent one that is applicable across Swiss HEIs of different nature, namely, universities, university of applied sciences, the ETH-domain and other institutions of different size. In order to do so, recORD has to draw on the diverse knowledge and expertise of its members and attempt building consensus on how to recognise ORD in research assessment in Switzerland.

As the review has shown, reforming research assessment goes far beyond implementing and developing new measures, but must be considered as an important change in research culture.

This goes hand in hand with values on conducting responsible research. In this context, ORD, and how to collect and share FAIR data is only one component that needs to be taken into account. The core values identified and elaborated on in this review stretch over the full research cycle and apply to all disciplines. Therefore, the establishment of the proposed values and applying them to ORD is an important step forward in itself. When setting up recommendations recORD should verify their alignment with these core values.

Section 5 has revealed both consensus or disagreements within the frameworks, identified good practices, highlighted challenges, and specified areas for improvement or action across the three assessment levels of the recORD project – namely, research proposals, researchers, and research units and institutions. That discussion was framed around the core values and the most important lessons are formulated as propositions and can be summarised as follows: 1) Consider assessment levels and metrics pitfalls when selecting ORD-related indicators; 2) Assess ORD quality through the FAIR principles, data curation, and data peer-reviewing; 3) Be cautious when assessing ORD impact quantitatively; 4) Account for ORD practices beyond research outputs; 5) Acknowledge disciplinary heterogeneities in ORD practices; 6) Ensure equitable ORD assessment of researchers; 7) Promote responsible sharing of ORD; 8) Guarantee transparent and iterative ORD assessment. These propositions will be the centre of the three upcoming recORD-workshops and will be thought along the three assessment levels.

Due to the complex nature of the needed change, all stakeholders should take part in the change process, and more specifically, funding organisations, such as the SNSF in Switzerland, which are central actors with the power of producing new policies for the entire academic field, should be central actors of any reform on research assessment.

This review is the first of several deliverables of recORD. The other deliverables will build on this review, and more specifically, the values, frameworks, and proposals laid out in this document. Hence, we consult the readers to consider this review jointly with the upcoming resources developed within recORD.



## 7 Further readings and useful weblinks

In the above review, we have given an overview of different frameworks on reforming research assessments by introducing ORD. While conducting the review, we have identified literature and online resources that can be of interest to readers. These are presented in the following section.

For further exploration and valuable resources on ORD assessment, two reports are worth readings. First, the GraspOS project computed an extended literature review in 2023 (see Hyrkkänen et al., 2023) including a comprehensive list of initiatives and projects related to open science responsible assessment, and they proposed an overview of the use and handling of quantitative indicators and qualitative input, as well as the current software infrastructures supporting research assessment. Second, the FAIReR project proposed an overview of the current state of responsible assessment of open science and research data for research careers in European research performing organisations (Mustajoki et al., 2021). This report grasps existing policies and information regarding researcher assessment, particularly focusing on the integration of FAIR data principles.

Additionally, various tools, both promising and already in use, offer avenues for accessing further resources:

- [Reformscape](#) is a searchable collection of criteria and standards for hiring, review, promotion, and tenure from academic institutions. Developed by the Tools to Advance Research Assessment (TARA) project linked to DORA, this database also provides examples of research-assessment and career-development policies from research institutions worldwide policies for organisations transitioning to new forms of research assessment.
- The [Open Science Assessment Registry](#), currently developed by GraspOS building on TARA, will provide an online database about open science assessments, such as assessment processes, indicators, case studies and lessons learned, to promote experience sharing and mutual learning.
- The GraspOS customisable [Dashboard Services](#) will offer a practical tool for collecting and structuring qualitative and quantitative information using the Openness Profile firstly developed in the Knowledge Exchange project (Jones & Murphy 2021).

The Openness Profile allows the automatic collection of data for the indicators, and for end users to manually annotated and describe their achievements.

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