Reproducibility Promotion Plans for Funders

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WHAT IS THE REPRODUCIBILITY PROMOTION PLAN FOR FUNDERS?

The Reproducibility Promotion Plan for Funders (RPP) is a policy template containing specific recommendations that can support research funders develop internal practices as well as manage and inform researchers of the expectations regarding reproducibility practices in the research they fund. Ensuring that funders have the tools and guidelines to strengthen reproducibility is essential. The RPP can help research funders and governmental institutions consider the structural and policy-based hindrances to the adoption of reproducible practices in the research they fund.

The RPP was co-created by a dedicated group of international funders, ensuring that the recommendations meet the real needs of funders when implementing policies or guidelines around reproducibility practices in the research they fund. Over the course of several interactive workshops, three main themes were mapped out: policy & definitions, evaluation & monitoring, and incentives. Specific recommendations were then developed for each theme, addressing different levels of readiness to ensure that funders with varying expertise regarding reproducibility can use and benefit from the RPP. Moreover, each recommendation comes with guidance on how to implement it, including examples from other funding institutions, enablers, and potential barriers, as well as ways to overcome these. Additionally, a visual representation highlights where each recommendation can be implemented along the funding lifecycle to support the implementation of the recommendations.

FOR WHOM IS THE RPP RELEVANT?

The RPP provides information relevant to people working in research funding organisations that are involved in the call development, monitoring, and evaluation process, as well as researchers who apply for funding.

HOW TO USE THE RPP

Given the geographic and epistemic diversity among funders, some recommendations may not be applicable across all funding contexts. For this reason, the RPP should not be seen as a 'one-size-fits-all' solution, but rather as a tool that can be used flexibly and adapted to meet funders' specific needs. We recommend that funding organisations identify and assess their areas for change and then select and prioritise the recommendations accordingly. It is not necessary to adopt all recommendations from the RPP. Adopting one or even two can help enhance and drive change towards a more transparent and reproducible research culture.

RECOMMENDATION PD1:

Funding organisations can ensure that there are guidelines in place which cover open science and reproducibility for their funding calls.

EXPLANATION:

For example, adding a couple of sentences about reproducibility into the “Quality and Impact” section of calls. This information can include scenarios where open science and reproducibility are recommended or best practices, as well as examples where it is not feasible or expected.

ADVANCED FOLLOW UP IMPLEMENTATION OF THE RECOMMENDATION:

Funders should ensure their definition overlaps with their own requisites for reproducible practices during monitoring and evaluation.

EXPLANATION:

It is important to highlight that there needs to be alignment between the definition of reproducibility and the required reproducibility practices, which may be specific to epistemic contexts and are therefore not expected or applicable to all disciplines.

BEST PRACTICE:

- Funding institutions should assemble a working group with multidisciplinary backgrounds to define the vision for how reproducibility aligns with their institutional values and practices.

POTENTIAL BARRIERS & FACILITATORS:

- Time and resources required to update funding calls may be perceived as a bureaucratic burden on funding organisations.
- Describing too many or non-relevant practices may decrease the motivation and uptake by the researchers.
- Difficulties implementing in ways that are meaningful across disciplines.
- \+ When funders give a clear statement that reproducibility is captured in their own policies, this signals to researchers and other stakeholders that this is valued by the organisation.

RECOMMENDATION PD2:

Funders should use a clear definition for reproducibility in grant calls. This definition should be in a common and simple language.

EXPLANATION:

A clear definition, which incorporates high-level values to define reproducibility, helps maintain a common language and understanding of reproducibility, especially for those researchers who are not experts in the topic.

RATIONALE:

A clear definition in grant calls can help researchers have a clear idea of what is expected of them. Common and simple language in terms of defining reproducibility can help coordinate funders and funding institutions in their pursuit to promote reproducibility.

BEST PRACTICES:

- Brief definitions on key terms around Reproducibility can be found in the iRise Reproducibility Glossary: https://doi.org/10.17605/OSF.IO/BR9SP.
- Defining other high-level values (e.g. transparency, rigor, openness) as they can enhance epistemic diversity. Highlighting that the absence of normative Open Science and reproducibility practices should not be interpreted as an absence of trustworthiness, robustness, or quality, but encouraging researchers to strive for transparency within their research.
- Reproducibility at its highest level refers to the ability to obtain consistent results/findings when repeating studies and analyses. However, it can be defined through methods and results reproducibility, respectively. Method reproducibility is defined as reproducible in principle, as there is sufficient documentation of methods, protocols, data, and code which enable others to reproduce the study. Results reproducibility is defined as successful reproduction/replication when the study is repeated (the results are sufficiently similar across both studies). For qualitative research, reproducibility is valued but can, in cases, be seen as less applicable.
- Conceptions of reproducibility across domains and disciplines vary, where for some it may be more applicable and for others less so. Therefore, it is important to consider the purpose and grounds of the research to see the feasibility and importance of reproducible practices. In cases where reproducibility is less applicable, the values of transparency should be upheld.

RECOMMENDATION PD3:

Funders should provide context for the importance of reproducibility to the research they fund.

EXPLANATION:

A description of the importance of reproducibility can increase openness in communication between funders and researchers and motivate researchers to engage in these practices.

RATIONALE:

The definition and explanation for the importance of reproducibility need to be clear and concise to reduce additional documentation that needs to be created by funders and interpreted by researchers and research institutions. Additionally, the motivation for the importance of reproducibility needs to supplement the definition to illustrate to researchers that this is not one of many requirements, but truly important.

BEST PRACTICE:

- Funding organisations can provide awareness-raising training for funders and researchers within and between funding organisations to enhance knowledge on reproducibility and its importance in research.

RECOMMENDATION PD4:

The definition of reproducibility should consider and clarify epistemic and disciplinary differences.

EXPLANATION:

Due to varying epistemic and disciplinary differences, a rigid definition can create complexities and hinder the progress of certain disciplines. However, if necessary or if the funding organisation is specific to one field, definitions should be adaptable and made clear for specific domains. Potentially using high-level defining values instead of a rigid definition.

RATIONALE:

When funders do not consider epistemic and disciplinary differences, they inhibit the quality and feasibility of the research they are funding.

POTENTIAL BARRIERS AND FACILITATORS:

- Feasibility, in consideration of the disciplines being too diverse

FURTHER READING:

- A pre-print from Leonelli discussing reproducibility and Open Science, taking into account situations in which they may not be relevant in light of epistemic diversity: https://doi.org/10.1017/psa.2022.45.
- A pre-print which discusses enablers and barriers to Open Science and reproducible practices in relation to qualitative research. The review provides insight into practices which can enhance reproducibility and transparency in qualitative research: https://osf.io/n5zkw_v1.
- A scoping review which investigated the effectiveness of existing Open Science practices in improving reproducibility and replicability: https://osf.io/preprints/metaarxiv/a8rmu_v1.
- A pre-print which discusses enablers and barriers towards reproducibility from the perspective of different stakeholders: OSF | How to get there from here? Barriers and enablers on the road towards reproducibility in research.

RECOMMENDATION PD5:

Funders who have endorsed reproducible research practices at any stage of their funding life cycle should provide researchers with examples of how to implement these reproducible research recommendations.

EXPLANATION:

If best practices are shared with researchers, they have detailed guidance with examples of behaviour or practices that are of good quality. A key touchpoint is identified as the stage where researchers are filling out funding applications. Best practice examples can act as inspiration to researchers and provide researchers with clear use cases of what the funding organisation considers relevant and sufficient when researchers are taking reproducibility into account. This may lead to a higher likelihood that researchers will embed these practices into their projects. For example, funders can present a “menu” of relevant practices for researchers to choose from and implement in their project.

RATIONALE:

Where researchers have detailed guidance with examples of behaviour or practices that are of good quality, there is a higher likelihood that researchers will embed these practices into their research.

BEST PRACTICES:

- The 'Ensuring Value In Research Funders' Forum' has decided on guiding principles to maximise the probability of impact of the research they fund. Within the principles, examples of applicability are given: https://evir.org/our-principles.
- Provide examples of reproducible research practices, together with restrictions, i.e. highlight that data should be as open as possible, but closed as needed (for example, when working with patients or sharing human genetic data).
- The UKRN Primers initiative introduces important topics in open and reproducible scholarship: Primers | UKRN.
- A tool called Systematic Online Living Evidence Summary (SOLES) is an online resource which identifies, synthesises, and evaluates information on existing candidate interventions and tools to improve reproducibility: https://camarades.shinyapps.io/irise-soles.

RECOMMENDATION PD6:

Funders should share their best practices and guidelines publicly to increase transparency and uptake.

EXPLANATION:

Transparent sharing supports other funders to find inspiration to set their own guidelines. Where some larger funders or early-adopters can make "the first move", the written guidelines can be shared with smaller funders or "later" adopters to increase transparency. This sends a clear message to researchers and other key stakeholders that funders take this topic seriously.

RATIONALE:

This recommendation assumes that funders who aim to incorporate reproducibility values or practices into their guidelines or recommendations would benefit from viewing the reproducibility guidelines of other institutions to support them in their drafting. There is also an assumption that this transparent behaviour increases the uptake of these reproducibility behaviours across more organisations.

RECOMMENDATION EM1:

Funding organisations should specify in their funding programs which reproducibility practices are being evaluated and monitored, and why.

EXPLANATION:

Reproducible practices are different across fields and disciplines. Funders need to be aware of the various existing practices and decide which practices are relevant and thus will be monitored in their funding lines.

BEST PRACTICES:

For quantitative research, where feasible and relevant funders can evaluate and monitor the use of Open Science and other tools at different stages during the research process. Below is a not non-exhaustive list, but serves as examples:

- Research design:
  - pre-registrations of research protocols (Create a Preregistration - OSF Support).
  - open registered reports (Registered Reports (cos.io)) which qualify as official grant outputs .
  - data management plans (DMPTool).
  - open protocols (protocols.io) and open methods (PRO-MaP recommendations).
- Data collection and analysis:
  - the availability of open data on repositories (Zenodo, ARC), open code books and electronic laboratory notebooks.
- Whilst in qualitative research contexts funders can evaluate and monitor the use of:
  - qualitative pre-registration (Qualitative Preregistration (cos.io)).
  - reflexivity and positionality statements (example statements).

POTENTIAL BARRIERS & FACILITATORS:

- Increase of bureaucratic burden on funding organisations
- Selecting too many or non-relevant practices may decrease the motivation and uptake by the researchers

- Selecting appropriate reproducibility practices to be monitored in the respective funding lines increases the relevance for researchers
- Providing rationale and additional explanation as to why these specific practices were selected and will be monitored enhances the uptake by the community and the researchers' motivation.

RECOMMENDATION EM2:

Funding organisations can ensure that criteria for reproducibility are embedded at multiple stages across the funding lifecycle (Figure 1), in particular at the evaluation and monitoring stage.

EXPLANATION:

1. During the proposal stage, funders should require researchers to specify in their proposal how they plan to account for reproducibility, ie. what reproducible research practices they plan to implement in the project.

2. Make it clear to proposal evaluators that reproducibility criteria need to be assessed and provide mechanisms for evaluators to be required to evaluate these aspects. For this, evaluators need to have the necessary knowledge of or experience with reproducibility practices (for example, pre-registration, the production of data management and analysis plans). Further, providing links to best practices of adhering to these criteria can support grant applicants, grant reviewers, and grant awardees to comply with recommendations upon submission of the proposal and research outputs throughout the project life cycle.

RATIONALE:

Embedding reproducibility at multiple stages in the grant submission, evaluation, and monitoring stages tries to overcome the risk that reproducibility criteria to transition from compliance to implementation. This aims to further support researchers to consider reproducibility at all stages of the project lifecycle. Where reproducibility is highlighted across multiple stages in the research cycle, there is less likelihood that bad practices can creep in.

RECOMMENDATION EM3:

Funding organisations should decide and describe at which level reproducible practices will be monitored and evaluated.

EXPLANATION:

Monitoring can take place at the program level, measuring the program's impact on reproducibility. While it could also take place at the individual-funded project or researcher level, measuring impact on reproducible practices at a smaller scale (for example, requiring pre-registrations, open data, and open methods).

RATIONALE:

Deciding at which level a funder wants to require researchers to engage with reproducible practices depends on the outcome intended to be measured, available capacities, and epistemic contexts. It should be communicated clearly to the researchers at what level of monitoring is taking place.

POTENTIAL BARRIERS & FACILITATORS:

- Lack of capacity (e.g., personnel or time)

RECOMMENDATION EM4:

Building on EM3, funding organisations should monitor reproducible practices at multiple time points of the funding and research cycle. Funders should (1) review plans for reproducibility measures in grant proposals before funding decisions are made and (2) check for completed reproducibility activities and practices during the project or after project completion.

EXPLANATION:

Monitoring reproducible research practices throughout the timeline or at multiple stages of the funded project ensures that researchers constantly apply these practices, advancing the rigor and reproducibility of the projects.

RATIONALE:

Reproducible practices are dependent on the stage in the research cycle the funded project is at. Monitoring practices throughout the lifetime of the funded project ensures that all aspects of reproducibility are captured and evaluated. This allows funders to identify potential issues or deviations early on and promotes consistent adherence to best practices.

BEST PRACTICES:

- After project completion, check if all reproducibility measures indicated in the grant proposal have been implemented.
- Monitor if project results are being reported openly and in a timely manner. This may include sharing of raw data as well as publication of null results.

POTENTIAL BARRIERS & FACILITATORS:

— Lack of capacity (e.g., personnel or time)

— Increase of bureaucracy

\+ Monitoring at multiple time points demonstrates to researchers that the practices are being valued and taking seriously, this will improve uptake by the researchers

RECOMMENDATION EM5:

Funding organisations should develop and integrate automated approaches into reporting to streamline monitoring of reproducibility practices.

EXPLANATION:

These automated approaches need to be robust and of high quality to ensure usefulness as well as encourage trust among the funder and research communities. Newly developed or specifically adapted tools may be necessary. A specific focus on interoperability between funders may increase their usefulness and applicability also within the research community.

RATIONALE:

Automated approaches may decrease the burden on resources by supporting personnel and reducing their workload, and improve the efficiency of monitoring processes.

BEST PRACTICES:

- At a high level, the EOSC Monitoring Framework can be used as a base for developing monitoring frameworks: EOSC Monitoring Framework .

POTENTIAL BARRIERS & FACILITATORS:

+ − Monitoring reproducible practices may increase the (bureaucratic and financial) burden on funding organisations and the research community. By integrating automated approaches into the grant evaluation and reporting, funding organisations can minimise this burden and may be able to use existing infrastructure to do so.

RECOMMENDATION EM6:

Funding organisations should allocate sufficient resources (e.g., personnel, time) to have the capacity to monitor the various reproducible practices.

EXPLANATION:

Funding organisations may either reallocate existing resources to have sufficient capacity to monitor practices or may need to acquire additional resources, for example, by hiring new personnel. Having adequate resources to secure the monitoring of reproducible research practices outlined in the funding program fosters adherence to these practices.

RATIONALE:

Monitoring reproducibility within research projects and programs may be cost-intensive with respect to personnel, time, etc. This cost increases if practices are being monitored at multiple time points of the project cycle or at different levels, for example, at the program and project level.

BEST PRACTICE:

- Funding organisations may allocate specific personnel to monitor and ensure compliance with reproducibility practices.

POTENTIAL BARRIERS & FACILITATORS:

− Allocating sufficient resources to monitor practices can increase the (financial) burden on the funding organisations

+ Practices which are being monitored and followed up with, as the funding organisation has sufficient capacity to do so, are being taken more seriously by the research community

RECOMMENDATION I1:

Ensure financial space to fund reproducibility in three ways;
a: Replication studies in your capacity as a funder
b: Ensure that applicants allocate sufficient funding in their budget proposals to safeguard reproducibility practices
c: Allocate more resources to projects that integrate reproducibility practice into the requirements of the funding call

EXPLANATION:

Innovation is not always the most sustainable, therefore, reproducibility is pivotal in research. Previous research needs to be assured for the quality and reliability of its findings to help innovation in the future become robust and therefore sustainable. Funding organisations can initiate the incorporation of reproducibility as a point of assessment in grant proposals by hiring personnel who are responsible for reproducibility practices, such as data managers, publication officers, and by supporting certain infrastructures that are helpful for respective disciplinary fields or epistemic contexts.

RATIONALE:

Only if funders emphasise reproducibility as an important element of the research endeavour will researchers take reproducibility more seriously and put more attention to it in their work.

BEST PRACTICES:

- The replication fund from NWO:
  - https://www.nwo.nl/en/researchprogrammes/replication-studies.
- Reproducibility funded program by the DFG:
  - https://www.dfg.de/en/news/news-topics/announcements-proposals/2022/info-wissenschaft-22-56.

POTENTIAL BARRIERS & FACILITATORS:

- Replication studies are not targeting innovation and groundbreaking research. This is regarded as most important by a lot of funders, and thus, this requires a culture change in the funding community.
- New types of bureaucracy which accompany replication studies (both for applicants and the funding body itself).

- When funders, publishers, and institutions take reproducibility practices more seriously, researchers will do so as well.
- Transitioning to a culture of reproducibility being accepted as the new norm.

RECOMMENDATION I2:

Funders should reward researchers who emphasise and enact reproducibility practices in their grant proposals and penalise researchers who do not engage and enact agreed reproducibility practices.

EXPLANATION:

Funders should incorporate reproducibility as part of quality and impact assessment, as increased use of reproducibility can uphold sustainability in research in the long term. Funders should encourage researchers who have not yet actively engaged in these practices to do so in the future by incorporating reproducibility as an element of quality assurance and assessment. If funders reward researchers already engaged in reproducible research practices, their intrinsic motivation is further strengthened.

RATIONALE:

Only if practices become mandatory will researchers follow the submission guidelines for applicants and ensure that they describe and monitor reproducibility practices. For funders, making practices mandatory would help to ensure compliance with new regulations.

BEST PRACTICES:

- Include how applicants will safeguard reproducibility practices in their future research projects that the funder may fund.
- Reproducibility is mentioned as an assessment criterium in grant review.
- Reward applicants who have a track record of actively engaging with reproducibility practices.
- Recognise reproducibility efforts through narrative CVs.
  - a.https://www.fnr.lu/narrative-cv/
- Guide on how quality measures can be written into proposals: https://www.dfg.de/en/news/news-topics/announcements-proposals/2022/info-wissenschaft-22-56.
  - Biomedicine and medicine: https://www.dfg.de/en/news/news-topics/announcements-proposals/2022/info-wissenschaft-22-56.

POTENTIAL BARRIERS & FACILITATORS:

- — Bureaucracy (for the applicant and the funding body)
- — Lack of compliance by both funders and publishers
- \+ Collaborate with publishers to further stimulate reproducibility practices at the beginning (funders) and at the end (publishers) of the research cycle
- \+ Make clear guidelines for applicants how to deal
- \+ Assure that the right infrastructures are used to monitor reproducibility practices

RECOMMENDATION 13:

Funders should support and reward applicants with extra resources (i.e. tools, Open Science practices, and infrastructures).

EXPLANATION:

Engagement with reproducibility practices can be done by providing extra resources (including financial and infrastructure) and reducing bureaucracy and workload caused by reproducibility practices. If funding institutions do not have the resources, they should direct researchers to available and free-to-use Open Science tools and infrastructures.

BEST PRACTICES:

- DFG covers costs for Open Data (e.g., transfer of data to public repositories, to gain access to research data): https://www.dfg.de/en/basics-topics/basics-and-principles-of-funding/research-data/resources-available.
- Directing researchers to existing resources and tools, e.g.:
  - Pre-registration and registered reports (OSF, AsPredicted).
  - Data Management Plan Tools (DMPTool).
  - Data Repositories (Zenodo).
- UNESCO Open Science Toolkit
  - UNESCO open science toolkit: contents - UNESCO Digital Library
- TOP Funders (cos.io)
- Incentivization Blueprint (Resources — Open Research Funders Group (orfg.org))

POTENTIAL BARRIERS & FACILITATORS:

- — Bureaucracy
- — (Smaller) funders might not have additional budget to financially support researchers,
- \+ Having (legal) frameworks for how to deal with non-compliance by researchers – potential ramifications for non-compliance include financial burden, a 'punishment' scheme

RECOMMENDATION 14:

Funders should encourage researchers to share best practices in reproducibility with other researchers. This enables funders to collect further ideas for showcasing, recommending, and/or mandating reproducible research practices.

EXPLANATION:

One example where funders can facilitate this is by building in sessions on reproducibility into conferences that funders support. Where funded conferences are required to have, e.g. a stream on reproducibility, this encourages researchers to share their practices with each other, as well as practices that were not as feasible or relevant to implement.

RATIONALE:

Encouraging researchers to share their reproducibility practices with other researchers in the field increases the likelihood that discussions on these topics are normalised in a research community and makes these positive/encouraged behaviours more visible. This enables funders to collect further ideas for showcasing, recommending, and/or mandating reproducible research practices.

BEST PRACTICES:

- Best practices for research integrity are collected and shared in an online portal.
  - https://wissenschaftliche-integritaet.de/en/code-of-conduct/cross-phase-quality-assurance/
- Networking events, webinars involving funding authorities and researchers.

VISUAL AID FOR IMPLEMENTING THE RECOMMENDATIONS

This figure illustrates the recommendations from the RPP at specific time points throughout the funding lifecycle. The timeline supports funders in their implementation efforts by highlighting the exact time point each recommendation can be implemented. The recommendations are colour-coded based on the main theme they fall under: policy and definition, evaluation & monitoring, and incentives.