SOPs4RI

D4.5: Third version of SOPs and guidelines

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1. Introduction

1.1. Abbreviations

APCs – Article Processing Charges

COPE – Committee on Publication Ethics

DORA – Declaration on Research Assessments

ECoC – European code of conduct

FG – Focus group

QRP – Questionable research practice

RE – Research ethics

RFO – Research funding organisation

RI – Research integrity

RIPP – Research integrity promotion plan

RM – Research misconduct

RPO – Research performing organisation

SOP – Standard operating procedure

SoR – Set of recommendation

TNA – Training Needs Analysis

1.2. Terminology

Code: a document guiding the members of an organisation on ethical standards and how to achieve them. Ethics/integrity codes are formal documents sending a message about moral standards guiding professional behaviour by providing principles, values, standards, or rules of behaviour.

Guideline: a statement of principles or issues to consider when performing a task, aimed to guide courses of action. Guidelines give direction and help users make decisions. They are often created based on the consensus of experts after detailed evaluation and assessment of available evidence. They may include checklists.

Heat map: a figure that shows researchers' and stakeholders' perception of the importance of the selected topics for RI at RPOs and RFOs.

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Standard Operating Procedure (SOP): a detailed, written instruction, aimed to achieve uniform action step-by-step. SOPs prescribe specific actions; they make it easier for users to make decisions. They may come in the shape of a 'decision-tree'/flow-diagram, similar to what is referred to as a practical decision making in clinical contexts.

Toolbox: a structured collection of easy-to-use tools (SOPs and guidelines) that RPOs and RFOs can use when developing their own Research Integrity Promotion Plans.

Research Integrity Promotion Plan (RIPP): a document describing how a specific institution will ensure, foster and promote responsible research practices, avoid detrimental practices, and handle misconduct. RPOs and RFOs should form their own RIPPs and consider disciplinary, organisational and national differences.

Set of Recommendation (SoR): list of recommendations for a subtopic that has been extracted from the documents that were provided by WP3. The teams will make the set per subtopic by discussing the documents and formulate practical and concrete recommendations.

Inspirations: main input of the Co-creation Workshops. It is created per subtopic and represents the Set of Recommendations in a visual manner. Inspirations are necessary for the methodology of the co-creation workshops.

Skeleton Guidelines: main output of the co-creation workshop. Skeleton guidelines are preliminary guidelines for each of the six topics/21 sub-topics addressed in the co-creation workshops. There are two versions of each skeleton guideline. Version 1 is a first rough version of the guideline based on the discussion in the first set of co-creation workshops. Version 2 is a more complete version refined with the feedback gathered during the second set of workshops. These guidelines aim to be as concrete and as practical as possible, but will be further harmonized and refined with future steps of the SOPs4RI project, particularly in WP6.

1.3. About SOPs4RI

The project Standard Operating Procedures for Research Integrity (SOPs4RI) aims to contribute to the promotion of good research practices and a strong research integrity culture aligned with the principles and norms of the European Code of Conduct for Research Integrity. The overall objective is to create a toolbox to support and guide research performing organisations (RPOs) and research funding organisations (RFOs) in fostering research integrity and consequently preventing, detecting and handling research misconduct. The project focuses on providing Standard Operating Procedures (SOPs) and guidelines that enable RPOs and RFOs to create and implement Research Integrity Promotion Plans (RIPPs). SOPs4RI will thus stimulate European organisations involved in performing and funding research to foster responsible conduct of research by organizational measures and policies. SOPs4RI takes a mixed-method, co-creative approach to the identification, development and empirical validation of SOPs and guidelines.

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The expected end-users of the tools provided by SOPs4RI are decision makers within RPOs and RFOs, e.g. university senior management (vice chancellors, deans, heads of administration), university academic councils, boards and directors of funding agencies, and their extended administrations. The identification and development of SOPs and guidelines will take national, epistemic, and organisational differences into account, and the final toolbox will enable RFOs and RPOs to create Research Integrity Promotion Plans in accordance with the needs of their organisation.

1.4. About WP4

Work Package 4 (WP4) serves as the backbone of SOPs4RI. WP4 creates, improves, sharpens and finalizes the content of the toolbox with SOPs and guidelines designed to support RPOs and RFOs.

WP4 builds on the empirical work of WP3. It used the inputs from the literature review, expert interviews and Delphi procedure to identify the needs of RPOs and RFOs in terms of topics to be covered in the toolbox. The first version of the toolbox with the SOPs and guidelines, version 1.0, was used in the focus group interviews (WP5). With the feedback from the focus groups (researchers, research integrity officers, policy makers, funding agency officers, etc.) the second version of the toolbox (version 2.0) was created. Using the sets of recommendation, co-creation workshops with stakeholders, and development of a repository of relevant resources, this current version (version 3.0) proposes preliminary guidelines for RPOs and RFOs.

Selected portions of Version 3.0 of the toolbox with SOPs and guidelines will then be tested in an international survey (WP6) among researchers. The survey will check and evaluate the content of the toolbox and create further knowledge on national and organisational differences in research integrity procedures and practices. The survey will identify barriers to implementation of the toolbox, and will make a cost-benefit analysis (CBA) to assess likely costs and benefits related to specific SOPs and guidelines. Version 4.0 of the toolbox will be piloted in a sample of RPOs and RFOs in WP7.

The final output of WP4 will be a ready-to-use toolbox with SOPs and guidelines for RPOs and RFOs (version 5.0).

The following components are part of WP4:

- Creating the first, second, third, fourth and fifth version of the SOPs and guidelines to be included in the toolbox.
- Conducting and reporting the co-creation workshops.
- Continuous communication and consultation with WP1 (coordination) and partners in SOPs4RI.

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1.5. About this deliverable

Deliverable 4.5 provides the third version of the toolbox with SOPs and guidelines. It highlights several activities that have taken place in WP4 to contribute to the formation of the next version of the toolbox. These activities include:

- the formation of extensive Sets of Recommendation informed by the Delphi study, the scoping review of guidance documents, and the results of the focus groups discussions which allowed to identify relevant topics and subtopics that are currently underdeveloped in research integrity policies;
- the formation of comprehensive and practical guidelines for 6 underdeveloped topics (21 Subtopics) by means of 24 co-creation workshops with policy experts (including research integrity officers, policy makers, institutional leaders, policy makers in RFOs and researchers);
- the development of a quality assessment system for deciding which research integrity tools should be included in the final version of the toolbox.

Deliverable 4.5 therefore builds on different work packages of the SOPs4RI project, details a refined set of skeleton guidelines intended to be used in the final toolbox, and sets the scene for upcoming deliverables in WP4:

- D4.4 Report on the co-creation workshops (KUL, M28)
- D4.6 Fourth version of SOPs and guidelines (VUmc, M34)
- D4.7 Final toolbox with SOPs and guidelines (version 5.0) (VUmc, M48)

2. Third version of the toolbox with SOPs and guidelines

2.1. Introduction of WP4

WP4 creates the new versions of the SOPs and guidelines after every empirical step (reviews, Delphi, interviews, focus groups, survey and pilot testing). Furthermore, it creates content for the SOPs and guidelines by conducting the co-creation workshops and it is interacting with the other WPs throughout the project.

WP4 will frequently seek advice from the Executive Board and the Advisory Board to steer the process of forming and testing the SOPs and guidelines.

WP4 bridges the empirical phases of the project and structures the content and form of the SOPs and guidelines that is going to be created. The aim is to identify existing, draft new, test, improve, and finalize the SOPs and guidelines that together will form the toolbox for Research Integrity Promotion Plans for RPOs and RFOs.

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2.2. Work package 4 objectives

The main aim:

To identify existing, draft new, test, improve, and finalize the SOPs and guidelines for the toolbox with input from the literature review, interviews, Delphi procedure (WP3), focus groups (WP5), survey (WP6) and pilot testing (WP7).

To achieve this, the following objectives have been formulated:

1. To develop a toolbox with research integrity SOPs and guidelines for RPOs and RFOs, which reflect the principles and norms of the European Code of Conduct for Research Integrity (ALLEA 2017).
2. To streamline the process of all the steps in the project (in close collaboration with WP1) within the 4 years of the project with the ultimate goal to deliver the toolbox.
3. To work with SOPs and guideline experts to construct specific SOPs and guidelines.
4. To ensure that the principles and norms of the European Code of Conduct for Research Integrity (ALLEA 2017) are translated into the drafts and final version of the toolbox.
5. To organise co-creation workshops with diverse stakeholders and incorporate their thoughts and ideas in the toolbox.
6. To help WP6 to validate and implement a procedure for a CBA (Cost Benefit Analysis) of the implementation of SOPs and guidelines.
7. To create the first, second, third, fourth and fifth version of the toolbox.

The objectives of D4.5 are to develop the third version of the toolbox. This version of the toolbox integrates the knowledge gathered from building the sets of recommendations, conducting the co-creation workshops, and developing a quality assessment system for inclusion of research integrity tools in the final toolbox. More specifically, this deliverable presents a new set of guidelines informed both by the insights of selected sets of recommendation and by the input from different stakeholders who participated in the co-creation workshop. The resulting guidelines presented in section 4.2 will continue to be refined in future steps of the project, but they provide a foundation for future work packages and upcoming versions of the toolbox. This deliverable also looks forward towards the survey and presents some of the topics and subtopics that will need to be addressed further in the coming steps of the project.

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2.3. Descriptions of the topics for RPOs and RFOs

As previously described in D4.2, the Delphi study, interviews and the scoping review guided the establishment of the prioritized list of the topics for RPOs and RFOs. In the two tables below the prioritized list of topics can be found. In total, 9 topics were developed for RPOs and 11 for RFOs (see table 1 and 2 below). Each topic also contains subtopics. This selection was done based on the consensus results and arguments from the Delphi and through discussion with the AB and Work Package leaders. In this selection process, we took feasibility and practical issues into account. Hence, some topics and subtopics may need a new SOP or guideline, while others already have many good examples.

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2.3.1. Descriptions of the 9 topics for RPOs (from D4.2)

Rank	Topic	Subtopics
1	Research Integrity Training	a. pre-doctorate b. post-doctorate c. training of RI personnel & teachers d. RI counselling and advice
2	Supervision and mentoring	a. PhD guidelines b. supervision requirements & guidelines c. building and leading an effective team
3	Dealing with breaches of research integrity	a. RI bodies in the organization b. protection of whistleblowers c. protection of those accused of misconduct d. procedures for investigating allegations e. sanctions f. other actions (including mobility issues)
4	Research ethics structures	a. set-up and tasks of ethics committees b. ethics review procedures
5	Data practices and management	a. guidance and support b. secure data storage infrastructure c. FAIR principles
6	Declaration of interests	a. in peer review b. in the conduct of research c. in appointments and promotions d. in research evaluations e. in consultancy
7	Research environment	a. fair procedures for appointments, promotions and numeration b. adequate education and skills training c. culture building d. managing competition & publication pressure e. conflict management f. diversity issues g. supporting a responsible research process (transparency, quality assurance, requirements)
8	Publication and communication	a. publication statement b. authorship c. open science d. use of reporting guidelines e. peer review

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		f. predatory publishing g. communicating with the public
9	Research collaboration	a. among RPOs inside/outside the EU b. with countries with different R&D infrastructures c. between public and private RPOs

Table 1: Ranked list of topics for RPOs after Taskforce Meeting in Vienna 13 Dec 2019. After this meeting, we have made small iterations on the names of the topics with the aim to increase usefulness and improve clarity.

2.3.2. Descriptions of the 11 topics for the RFOs

Rank	Topic	Subtopic
1	Dealing with breaches of RI	a. RI bodies in the organization b. procedures for breaches by funded researchers c. by review committee members d. by reviewers e. by staff members f. protection of whistleblowers and the accused g. sanctions/other actions h. communicating with the public
2	Declaration of competing interests	a. among review committee members b. among reviewers c. among staff members
3	Funders' expectations of RPOs	a. Codes of Conduct b. assessment of researchers c. education and training for RI d. processes for investigating allegations of research misconduct
4	Selection & evaluation of proposals	a. RI plan b. methodological requirements c. plagiarism d. diversity issues
5	Research ethics structures	a. research ethics requirements b. ethics reporting requirements
6	Collaboration within funded projects	a. expectations on collaborative research b. research that is co-financed by multiple funders
7	Monitoring of funded applications	a. financial monitoring b. monitoring of execution of research grant c. monitoring of compliance with RI requirements

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8	Updating and implementing RI policy	*No subtopics*
9	Independence	a. What counts as an unjustifiable interference? b. preventing unjustifiable interference by the funder c. preventing unjustifiable interference by political or other external influences d. preventing unjustifiable interference by commercial influences
10	Publication and communication	a. publication requirements b. expectations on authorship c. open science (open access, open data, transparency)
11	Intellectual property issues	*No subtopics*

Table 2: Ranked list of topics for RFOs after Taskforce Meeting in Vienna 13 Dec 2019

2.4. Evolution of the 9 topics for RPOs. Graphical illustrations of how the topics for the RPOs relate to each other

In earlier deliverables from WP4 (D4.1-D4.3), we already highlighted the evolution of the topics for the RPOs. This work resulted in a 2-pager where we describe the 9 topics in more detail. You can find this 2-pager on the SOPs4RI website. (www.sops4RI.eu). Below we give you the overview of the 9 topics and how they relate to each other.

	Topic	Examples
Prioritizing people and enhancing capabilities	**Research environment**	Responsible procedures for assessing researchers; Managing competition and publication pressure
	Supervision and mentoring	Guidelines for PhD supervision; Setting up mentoring schemes
	Research integrity training	Research integrity training for junior and senior researchers; research integrity counselling

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Building research integrity into organizational structure	**Research ethics structures**	Setting up ethics committees; Ethics review procedures
	Dealing with breaches of research integrity	Protection of whistle-blowers and researchers accused of misconduct; Procedures for investigating allegations
	Data practices and management	Guidance, training and infrastructure for data management; Implementing the FAIR principles
Ensuring clarity and transparency	**Research collaboration**	Guidance for collaboration with institutions in countries with different R&D systems; University-Industry collaboration
	Declaration of interests	Declaration of interests in research conduct, peer review, research evaluation, appointments, promotions and consultancy
	Publication and communication	Guidelines for authorship; Procedures for open science and communication with the public

Figure 1: Overview of 9 RI-topics for RPOs that correspond with the EcoC and shows us how they relate to each other.

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2.5. Evolution of the 11 RFO-topics. Description how we have merged the 11 topics towards 6 main topics and give a graphical illustrations of how the topics for the RFOs relate to each other.

In the evolution of the topics for RFOs we have the results of the Delphi study as a starting point as these 11 topics were shaped by the empirical cycles of our project and shaped by the interviews, reviews and focus groups. To further develop this list of topics we have set up a taskforce. In the taskforce, we explored the 11 topics, described them in more detail and examined how they relate to each other. One of the main concerns was already expressed in earlier iterative work (reviews, Delhi study, focus group study, cocreation workshops) that 11 topics could make the responsibility for RFOs unnecessary complex. In this paragraph, we provide a rationale for these decisions. First, several topics are already well covered by the responsibilities of RPOs and putting them as a responsibility would make it too complex and may even cause too much administrative burden. Thus we decided that these responsibilities should be part of the overall expectations for RPOs RFOs can have (such as dealing with breaches of RI, collaboration, implementing RI policy and Intellectual property issues; see figure 1). Second, there is a significant overlap of the 11 topics. This merge was important to give RFOs more insight in what are their core responsibilities and how they relate to each other. One example was that we found out that both declaring conflicts of interest and independence as Delphi topics have a lot of similarities. Besides, they have similar goals, namely making research as independent as possible, and when it is being influenced by external factors, there is policy in place how to deal with these influences. Third, we also wanted to include the most important elements in the toolbox for RFOs. To this aim, we also used the ranking exercises from the empirical work to make an evidence based decision what topics should be essential in the RFO toolbox. In Figure 1, we highlight how grouped the 11 topics under 6 overarching themes.

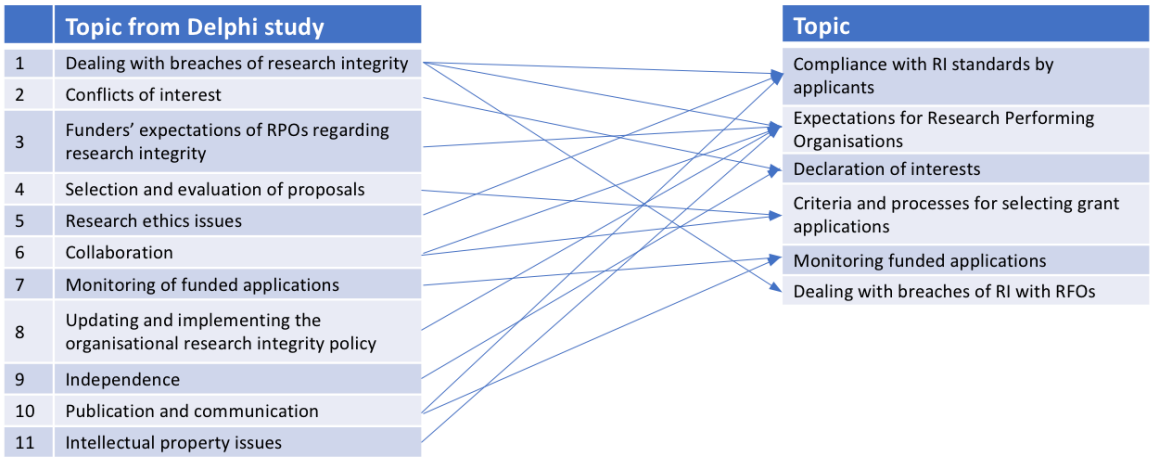

Figure 1. Overview how the 11 topics are distributed among the 6 final topics.

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How the 6 final topics relate to each other is sketched in Figure 2. What you can see there is that there are 3 overarching RFO duties. 1 is communicating their expectations related to RI towards RPOs and applicants, 2 is being transparent about how they evaluate applications on RI criteria and assure that potential competing interests are reported. And 3, have an internal structure organised in an RFO that can safeguard RI within staff members, committees and reviewers. The work on the RFO-topics will also result in a 2-pager where we describe the final set of topics in more detail. This 2-pager will be placed on our website (www.sops4ri.eu).

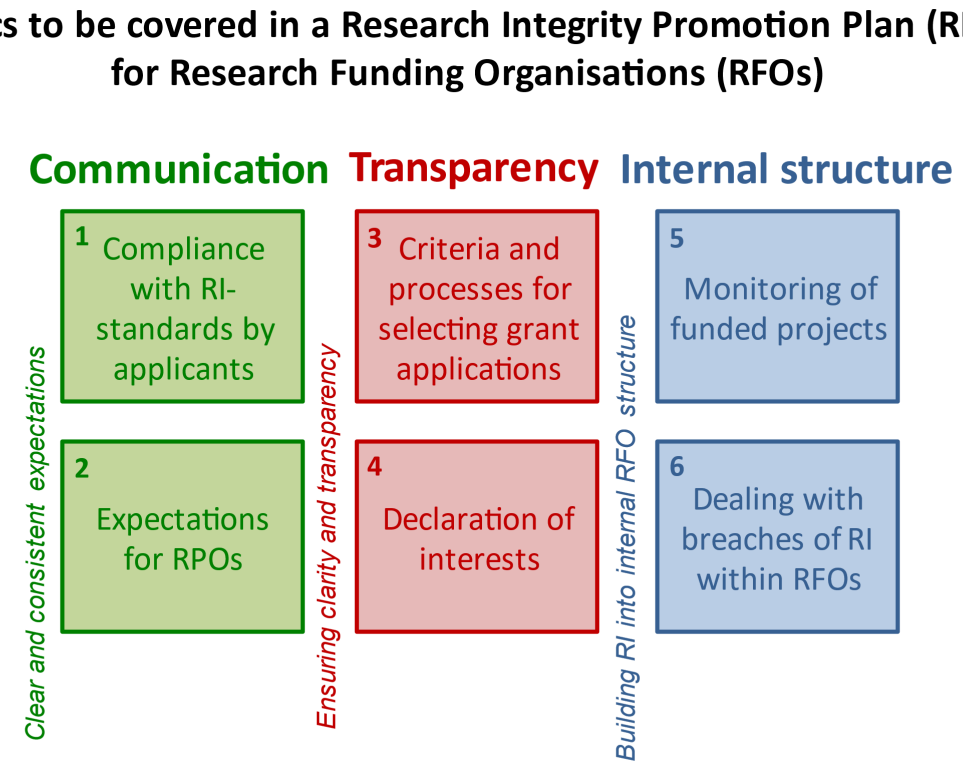

Figure 2. Schematic overview of the 6 RFO topics

2.6. Methodology towards the third version of the toolbox

2.6.1. Introduction

The third version of the toolbox builds on the first two versions of the toolbox. In the first version of the toolbox the results from WP3 (literature review, expert interviews and a Delphi study) were integrated to develop the first version. In particular, 9 topics were found to be important for RPOs to

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include in their RIPPs, and 11 topics were found to be important for RPOs. The second version of the toolbox presented concrete recommendations and accounts for disciplinary differences, building on the work of the focus groups (D5.2) and the work in WP4 for this deliverable. In this third version, we complement previous findings by adding insights from the developed Sets of Recommendations (SoRs), the co-creation workshops results, and we detail the plans for selecting the resources for research integrity that will accompany the toolbox.

2.6.2. Specific activities

The specific activities in WP4 for this deliverable are:

1. **Sets of Recommendations (SoRs)**
   The SoRs were developed based on the topics identified in the scoping review, the Delphi study (WP3), and the focus group discussions (WP5). We identified specific underdeveloped topics and subtopics that needed more input in order to form preliminary guidelines for these (sub)topics. In this deliverable, we present the final SoRs that were used to create inspirations for the co-creation workshops.

2. **Co-creation workshops**
   Co-creation workshops were used to expand 6 underdeveloped topics (3 topics for RPOs and 3 topics for RFOs) captured in the SoRs. We used the selected SoRs as inspiration for the first set of workshops. The first co-creation workshops lead to the creation of skeleton guidelines based on the perceptions, ideas and suggestions of policy experts. The skeleton guidelines were then examined in a second set of co-creation workshops, and the inputs were analysed to create a final set of guidelines.

3. **Quality assessment system for the inclusion of tools in the toolbox**
   The final toolbox will include a selection of high-quality tools on research integrity such as research integrity documents, policy, guiding resources, and codes of conduct. To decide which integrity tools will be included in the final toolbox, we will assess the quality from a comprehensive selection of research integrity tools retrieved in earlier steps of the research project. In this deliverable, we detail how the resources will be assessed and classified to ensure that all resources included in the final toolbox are of high relevance and quality.

2.6.3. Methodological steps

The methodological steps correspond to the specific activities as provided above. Further details on the methodology of each activity are provided within the sections dedicated to specific activities.

1: Sets of Recommendations

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- Select which subtopics will be covered in preparing the first sets of recommendations
- Define the first sets of recommendations based on existing resources and in discussion within the teams formed in WP4 and reflections of other experts
- Identify knowledge gaps and underdeveloped topics and subtopic
- Find documents that may help covering these knowledge gaps and draft recommendations
- Create a final list of recommendations that will serve as a baseline for building the material needed in the co-creation workshops.

2: Co-creation workshops

- Select 6 underdeveloped topics to be discussed in the co-creation workshops
- Conduct the first set of co-creation workshop, using 'inspirations' to evoke discussions among participants on selected topics (October 8 and October 21, 2020)
- Analyse the output of the first set of co-creation workshop to create a first version of skeleton guidelines
- Share skeleton guidelines with next set of co-creation workshop participants
- Conduct the second set of co-creation workshops in which participants comment on the specific recommendations included in the first version of the skeleton guidelines (November 24/25 and December 9, 2020)
- Analyse the outputs of the second set of workshops to create the second version of the skeleton guidelines

3: Quality assessment system for the inclusion of tools in the toolbox

- Retrieve document and resources which are relevant to include in the toolbox
- Tag the resource on a series of characteristics to help retrieval
- Create a summary of essential retrieval characteristics of each resource
- Assess each resource to ensure its usefulness for inclusion
- Assess each included resource a second time to provide a score on more specific indicators
- Make the tools available on the Embassy website

3. Sets of recommendations (SoRs)

3.1. Methodology towards the development of SoRs

Below we provide a summary of the key steps used towards the development of SoRs. The full methodological details are available in section 5.1 of 'D4.3 Second version of SOPs and Guidelines'. Based on the Delphi, the scoping reviews and the expert interviews described in greater depth in deliverables D3.1 to D3.4, 20 relevant topics were selected to address in the toolbox; 9 for research performing organizations (RPOs) and 11 topics for research funding organizations (RFOs) (the specific

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topics are described in section 2.3. Descriptions of the topics for RPOs and RFOs). We assessed the quality of existing best practice documents (e.g. guidelines, codes of conduct, SOPs) on these selected topics to map how far each topic has been addressed by existing resources that were found and recommended in the reviews, interviews, and Delphi's. For extensive information on this methodological approach, see D4.3. Based on this mapping, we found that some topics are already highly developed (i.e. are addressed by good quality existing resources), while others are underdeveloped or have not been addressed previously. The specific level with which each topic and subtopic was addressed in existing guidelines is described further in Table 6 and Table 7 of section 7.1. We then integrated the insights gained from the 30 focus groups from WP5 with the results of WP3 to further develop the toolbox and address underdeveloped topics. The goal of this development phase was to create a draft of guidelines/SOPs that contained a concrete set of recommendations (SoRs) for each underdeveloped topic and subtopic

Topics that were underdeveloped and highly ranked from the Delphi study were included as (sub)topics to be addressed in the third version of the toolbox. An overview of the topics selected at this stage can be found in the Second version of SOPs and Guidelines D4.3. Due to feasibility issues, we then further selected 6 topics to address during the co-creation workshops: three topics for RPOs (research environment, responsible supervision, and education and training in RI) and three topics for RFOs (selection and evaluation of proposals, monitoring of funded applications, and independence). We based our selection on several key features of the topics and used the ranking from the Delphi study to assure that we would cover the most pressing topics. To ensure that selected topics were appropriate for co-creation, we selected topics that were not legalistic, and that require us to learn about stakeholders' values in order to address the topic adequately.

To develop the SoRs for the selected subtopics, we assigned 4 small working groups from all partners that have PersonMonths in WP4. Among these 4 teams, several subtopics were allocated who were tasked to:

1. Read the suitable WP3 documents related to the topic and subtopic assigned;
2. Summarize the major themes from these documents and discuss them in the group;
3. Identify gaps in the resources read;
4. Look for, read, and summarize additional resources which might fill the gaps identified;
5. Formulate a SoR for each subtopic;
6. Flag the remaining gaps/questions and summarize them per subtopic.

The recommendations were formulated to be as concrete and operational as possible, and to take into account the perspective of the policy maker. The recommendations were then refined together with members of WP5 to account for disciplinary differences raised in the findings of the focus groups.

As we will describe in section '4.1Methodology used for the co-creation workshops', the sets of recommendations for 6 underdeveloped topics (RPO topics Research Environment, Responsible

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supervision and Education and training in RI; RFO topics Selection and evaluation of proposals, Monitoring of funded applications and Independence), were then used to create inspirations of the co-creation workshops. Inspirations contained a mix of textual and visual stimuli, such as concrete recommendations from V2 of the toolbox, ambiguous stimuli, as well as stimuli that are not relevant to the topic under discussion, to ensure a rich discussion with the workshop participants. Finally, the inspirations were revised and adjusted to taking into account the results of WP5.

Underdeveloped topics and subtopics which were not covered by the co-creation workshops were further refined in the teams to ensure that they can be a starting point for further development of policy documents that may have value for future use. See next steps section in this document for more information.

A more detailed description of the methods used to build the Set of Recommendations is available in the Second version of SOPs and Guidelines D4.3.

3.2. Lessons learned from the work of the SoRs

The full set of SoRs is detailed in APPENDIX 1. Results from the description of the sets of recommendations (SoRs).

The SoRs result from a broad effort in which the combination of expert input (i.e., the Delphi), existing resources (i.e., the scoping review), and topical explorations (i.e., the focus group) revealed a rich account of topics relevant to research integrity in research performing and research funding organisations. The resulting SoRs capture the breadth and richness of those topics and highlight several underdeveloped topics which we address in later steps of the project.

We realise however that despite the rich account of the SoRs captured, more depth and granularity must be added for the recommendations to be truly insightful. For this reason, the SoRs serve as the springboard upon which future steps of the project will build, but they will not be used in their entirety in final versions of the toolbox. The co-creation workshops helped to add a concrete and lived aspect to the initial SoRs by expanding on the meanings and interpretation of selected topics and by providing genuine best practice examples that will ensure that the resulting guidelines are implementable.

Furthermore, although the focus groups allowed a rich account of the disciplinary differences in the importance of the topics selected, the current SoRs do not provide in-depth knowledge on institutional, country, or disciplinary differences on the specific recommendations. The diversity of participants (stakeholders) included in the co-creation workshops, which included different experience, professional role, country, gender, and disciplinary field, is a first step in documenting these differences, but the survey (WP6) will be particularly relevant in addressing this gap since it will allow us to capture country- and disciplines-specific differences of the guidelines on a grand scale.

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4. Co-creation Workshops

4.1. Methodology used for the co-creation workshops

We conducted 24 CCWs during which we covered 6 topics (see Table 3). Only one topic was discussed per workshop, with each topic being discussed in 4 workshops in total. Of these 4 workshops per topic, two were held in October 2020 (the so called 'first set of workshops'), while the other two were held in November or December 2020 (the 'second set of workshops'). The first and second set of workshops were focused on content creation and content refinement, respectively. During the first set of workshops, we asked participants to create ideas for skeleton guidelines on each of the subtopics falling under the overall topic (e.g. for the topic 'RI education and training', we had a separate exercise for the subtopics 'Pre-doctorate RI training', 'Post-doctorate RI training', etc.). Additionally, we explored which guideline formats stakeholders prefer by asking them to compare the formats of 3 existing guidelines on RI. The input of the first set of workshops were the *inspirations* – short pieces of text or images that represented the SoRs produced in earlier stages of the SOPs4RI project – which we presented to participants to evoke ideas among them without pushing them too much into any specific direction. With the ideas generated in the first set of workshops, we drafted a first version of the skeleton guidelines, which we used as input for the second set of workshops. In the second set of workshops, we asked participants to comment on and refine the draft skeleton guidelines, as well as to discuss potential implementation issues of the guidelines. We used the ideas discussed in the second set of workshops to further refine and finalize the skeleton guidelines. All workshops were conducted on the collaborative whiteboard software program MIRO, as well as Zoom.

Greater details on the specific methodology used in the co-creation workshops is detailed in 'APPENDIX 2. Methodology towards the co-creation workshops'.

Table 3. Distribution of the co-creation workshop groups and topics

Organisation of groups and topics for the co-creation workshops

		1st set of workshops	2nd set of workshops	Analysis and guideline building
RPOs	Research environment	2 groups	2 groups	VUmc
	Responsible supervision	2 groups	2 groups	VUmc
	Education and training in RI	2 groups	2 groups	VUmc
RFOs	Selection and evaluation of proposals	2 groups	2 groups	KUL and EARMA
	Monitoring of funded applications	2 groups	2 groups	KUL and EARMA
	Independence	2 groups	2 groups	KUL and EARMA

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4.1.1. Combining the SoRs with the results from the Co-creation Workshops

The steps used in order to create the SoRs to be used in the co-creation workshops are described in greater depth in section '3.1 Methodology towards the development of SoRs' above. In summary, we selected 6 topics — 3 topics for RPOs and 3 topics for RFOs, see Table 3 — that were underdeveloped in existing guidance; highly ranked in the Delphi study; not referring to legalistic issues; and that required us to learn about stakeholders' values in order to address the topic adequately. Each of these topics and related subtopics were then revised in small groups with members of WP4 and refined together with members of WP5 to account for disciplinary differences raised in the findings of the focus groups. The resulting SoRs targeted 6 underdeveloped topics (RPO topics Research Environment, Responsible supervision and Education and training in RI; RFO topics Selection and evaluation of proposals, Monitoring of funded applications and Independence), and a selection of them were then used to create inspirations for the co-creation workshops. Inspirations contained a mix of textual and visual stimuli to represent each recommendation in the SoRs either directly, using ambiguous pictures or words, or negatively (e.g. representing the opposite of the recommendation) to ensure a rich and open discussion with the workshop participants.

Two sets of co-creation workshops were conducted, each containing two groups per topic (refer to 'APPENDIX 2. Methodology towards the co-creation workshops' for more detail). After each set of workshops, the transcripts and visual working boards used in the workshops were analysed independently by a minimum of two researchers in an 'analysis workshop' during which the results were grouped together visually on a joint working board in the MIRO software. For each topic, one researcher then used the findings of the workshop to complement, refine, or adapt the recommendations. More specifically, the findings of the first sets of workshops served to adapt the initial SoRs to create a 'skeleton guideline', while the findings of the second sets of workshops served to refine the 'skeleton guidelines V1' to create the final versions of the guidelines (skeleton guidelines V2). On both instances, the refinement, addition, or removal of recommendations was documented. In the present document, recommendations that resulted from the initial SoRs rather than from the co-creation workshops are displayed in blue in the next sections. More extensive information on the recommendations that were included and excluded in the final guidelines will be available in the deliverable D4.4.

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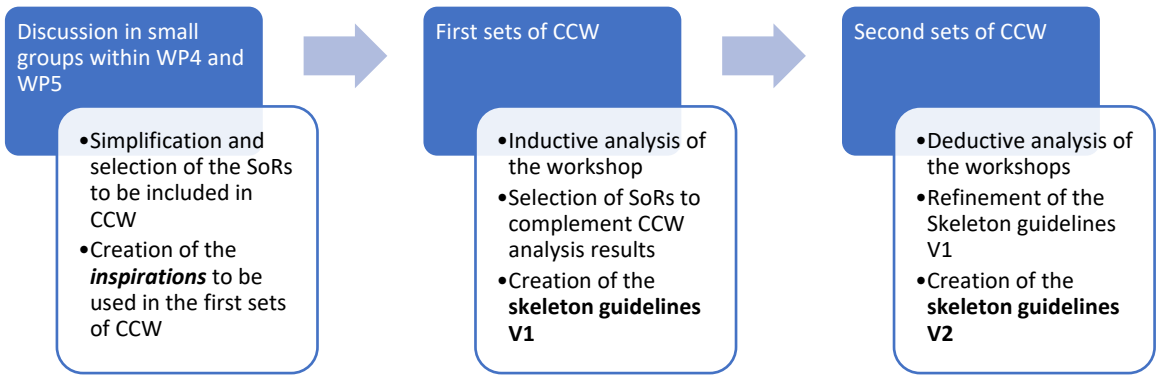

Figure 3. Co-creation workshops steps and outputs

4.2. Results from the CCW

The following sections showcase the guidelines resulting from the co-creation workshops (i.e., skeleton guidelines V2). These guidelines consist of the 6 topics and 21 subtopics based on the input of the co-creation workshops, and revised based on a selection from the SoRs.

After each recommendation item, we include a short explanation to describe how the item was discussed in the workshops. These short explanations will not be included in the final guidelines, but we considered them relevant to better inform the future steps of the project (e.g., WP6 and WP7).

While these guidelines provide a good baseline for the toolbox, they will continue to evolve in future steps of the project. At the moment, each subtopic was built as a standalone guideline with its own points and issues. In addition, we purposefully prevented the guidelines from becoming too prescriptive to ensure that they could apply to different settings, and different disciplines with different baselines. The resulting guidelines are thus extensive, general, and sometimes overlapping with one another. In future steps of the project, we will harmonize the guidelines to ensure that there is limited overlap and no incompatibilities between the different topics within each set of guidelines (i.e., the set for RPOs and the set for RFOs), and we will use the survey to find international baselines upon which we can craft tailored and prescriptive recommendations.

Note: Throughout these guidelines, recommendations written in blue were included in the skeleton guidelines from the initial SoRs, while recommendations written in black were directly mentioned in the co-creation workshops.

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4.2.1. Results from the CCW for the RPO topics

4.2.1.1. Education and training

Pre-doctorate research integrity training

Title of skeleton guidelines:

Guidelines on pre-doctorate research integrity training for research institutions

Guidelines:

At the Bachelor/Master level:

1. **Integrate research integrity training into the curriculum, making it mandatory**
    a. As a part of the introduction to the institution
    b. As a part of the thesis writing process
    c. Providing adequate contact hours for trainees

Explanation: Participants in both sets of workshops discussed the importance of starting research integrity (RI) training as early as possible. There was some disagreement in the first workshop about whether the starting point should be the bachelor or master level, since bachelor students might not have any actual experience with research, but some participants in the second workshop explained that all students including those at the bachelor level will experience research to an extent. In fact, there were even suggestions in the second workshop from one participant that starting at the bachelor level is already too late, since many students experience research for the first time in high school and might learn irresponsible research behavior already at that point. Points 1a and 1b were suggestions of where in the curriculum to place RI training; 1a was suggested in the second set of workshops, whereas 1b was mentioned in both sets. Furthermore, item 1c was added from the SoRs, but confirmed as important to ensure that students do not see RI training as something optional, but rather mandatory and important.

At the PhD level:

1. **Deliver a mandatory course about the basics of research integrity at the start of the PhD**
    a. Employ trainers with general expertise in research integrity or collaborate with trainers in other institutions
    b. Empower trainees to speak up in their teams, by teaching them about institutional policies.
    c. Provide RI trainings as complete courses rather than one-off workshops, providing adequate contact hours.

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d. Provide RI training in multidisciplinary groups during which participants from different disciplines are given the opportunity to discuss and address the specific challenges faced in their disciplines.

Explanation: Participants in both sets of workshops explained that in order to ensure that all PhD students who need RI training receive it – rather than only those who are interested in RI in the first place – it is important to deliver mandatory RI training. They suggested to do this at the start of the PhD to ensure that students had the basic awareness and skills about RI early on. Item 1a arose from discussions in the first workshop set, where some participants suggested that the most suitable person to deliver the mandatory training would be someone with general knowledge about RI, rather than someone with more specialized knowledge (e.g. about data management). In the second set of workshops, some participants were concerned that not all institutions might be able to employ their own trainers; therefore item 1a offers some flexibility and guides institutions with less resources to collaborate with other institutions or trainers. Item 1b was based on discussions in the first set of workshop, where some participants mentioned that awareness about policies and rules can empower students to speak up about RI to those higher in the hierarchy, and that this would be highly desirable. In the first set of workshop, it was already suggested that this basic RI training for PhD students should consist of a course, rather than a smaller event (item 1c). Finally, some participants in the first workshop highlighted the importance of providing the training in a multidisciplinary context, to allow exchange of experiences and cases from different disciplines in the training (item 1d).

2. **Follow up with elective specialized courses throughout the PhD**
    a. Employ trainers with specialized expertise or collaborate with trainers in other institutions
    b. Refer students to existing educational resources such as codes of conduct, online training, or other relevant guidelines

Explanation: It was already discussed by many participants in the first set of workshops that basic RI training at the PhD level needs to be supplemented with follow up courses on specific topics (e.g. data management) further on in the PhD. This is because as students progress in their research, they will uncover new RI questions and challenges. To allow students to follow the specialized courses that are most useful for them, these participants suggested to keep follow up courses optional. However, in the second set of workshops, one participant was concerned that it would be very difficult to coordinate the delivery and uptake of optional specialized courses. Item 2a was brought up in the first set of workshops, and slightly modified after the second set of workshops where some participants were concerned that not all institutions will have the means to hire their own trainers. Item 2b is based on suggestions from the second set of workshops, that referring students to resources can

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already be good enough when institutions do not necessarily have the means to offer follow up courses themselves.

3. **Encourage and support informal discussions at departments or research teams to supplement formal training**
    a. Mix junior and senior researchers in some of these sessions.
    b. Foster multi-disciplinary discussions.

Explanation: Item 3 was raised in the first set of workshops, where many participants highlighted the importance of sharing experiences and problems in informal meetings for RI education. They suggested to have mixed-rank groups for some of the sessions to allow for sharing of different types of experiences, and learning across ranks (item 3a). In the second set of workshops, some participants stressed that having multi-disciplinary informal discussions is especially useful as much of research today is multidisciplinary (item 3b).

<u>At all pre-doctorate levels:</u>

1. **Employ respected, enthusiastic and qualified trainers**
    a. Employ a set of trainers to ensure expertise in all aspects of RI are covered (e.g. ethics, data management, open science, etc.)
    b. If possible, hire trainers from inside the institution.
    c. If not possible to hire internal trainers, collaborate with trainers or training programs from other institutions
    d. Involve faculty in the delivery of trainings

Explanation: Participants in both sets of workshops discussed the importance of hiring suitable trainers for RI training. In the first set of workshop, participants mentioned that a suitable trainer has the following characteristics: young, good communicator, enthusiastic, researcher. In the second set of workshops, one participant emphasized the importance of ensuring that trainers are sufficiently trained and qualified to offer good RI education. Another participant in the second set of workshops explained that a good trainer of RI does not necessarily need to do research, but must learn enough about it to train others. Yet another participant explained that the most important feature of trainer is that they are respected by those they train, as if they are not, then the training material will not be taken up successfully. Taking these considerations together, we decided to not make any judgments in the guideline about the age or profile of the trainers, as different institutions can go for different options, but to emphasize the importance of hiring trainers that are sufficiently qualified, enthusiastic, and respected. Item 1a arose because some in the second set of workshops mentioned that a team of trainers with different types of expertise might be needed. Items 1b and 1c are based on insights from the second set of workshops about how internal trainers are most suitable since they

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know the local context best, but that it might not always be possible hire these. Item 1d is from results of the first set of workshops, where some participants suggested that it can be helpful to have senior colleagues deliver the trainings, to show support for RI and illustrate its importance for practice.

2. **Use blended-learning formats to allow for continuous learning**
    a. Communicate to trainees that they are on a continuous path of research integrity training
    b. Ensure that trainees can turn back to the training material to look at the content later.

Explanation: This item was discussed and agreed on in both sets of workshops. In the second set of workshops, some participants highlighted that blended learning formats are most suitable for continuous training, as they allow trainees to go back to training materials to look at the content again (item 2b), and since they allow for the formation of online support groups. Furthermore, in the second set of workshops, participants suggested to communicate to trainees what the added value of the blended-learning format is for continuous learning so they can make the best use of it (item 2a).

3. **Emphasize practice over theory in RI education and trainings**
    a. Consult with potential trainees on what to cover during training and update the training based on trainees' needs
    b. Teach students the basic values of research integrity
    c. Focus on the daily practice of research, rather than emphasizing ethical theory
    d. Integrate relevant practical elements of research ethics issues into research integrity trainings
    e. Address cultural differences in the understanding of research integrity during training
    f. Discuss case studies and real-life examples during training

Explanation: One of the participants in the first set of workshops stressed that training should not focus on ethical theory, as that is not what is most interesting or relevant to students. Many other participants in both sets of workshop agreed with this, and suggested to emphasize the practical issues of RI in training, rather than focusing on ethical theory. Item 3a came up in the second set of workshops, where some participants highlighted that it might be useful to consult potential students about what to include in courses, to ensure that courses' emphasis remain close to practice. Items 3b-3e were brought up in the first set of workshops, to explain that while some basic theory (e.g. about values) can be introduced to students, it should be integrated into the trainees questions about their

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own research. Item 3f was discussed in both sets of workshops, where there was strong agreement to use case studies and real-life examples to keep training programs close to practice.

4. **Motivate trainees using tangible incentives and positive instruction**
    a. Clearly communicate the purpose of research integrity training (e.g. improving research quality, helping with grants, etc.)
    b. Explore what rewards motivate trainees and tailor rewards accordingly
    c. Focus on a positive approach to research integrity rather than on research misconduct or on telling trainees what to do.

Explanation: In the first set of workshops, some participants suggested to provide trainees with tangible incentives for training, such as digital badges, as that would be sufficient for this target group. However, in the second set of workshops, some participants explained that incentives and rewards should be tailored, as different trainees might appreciate different types of incentives. Therefore, they suggested to explore what rewards motivate participants and then tailor these accordingly (item 4b). Furthermore, items 4a and 4c were added based on discussions in the second set of workshops, where some participants highlighted that a good understanding of the benefits of RI training and a positive approach to RI can also motivate trainees.

5. **Evaluate training programs**
    a. Use subjective measures (e.g. trainees' perception of course usefulness)
    b. Use follow up measures (e.g. number of participants enrolled in elective courses)

Explanation: In the first workshops, some participants mentioned that to evaluate training effectiveness, students could be asked to reflect on RI in their thesis. While there was no disagreement with this particular point in the second set of workshops, the participants there discussed how evaluating 'effectiveness' of courses through objective means is difficult and maybe not even possible. Therefore, they suggested to evaluate training based on subjective means (item 5a) or on simple objective measures not related to effectiveness (item 5b). Therefore, we reformulate this entire item in the guideline to remove the word 'effectiveness' and add some flexibility in how training programs can be evaluated.

6. **Foster a positive research culture**
    a. As a prerequisite for training, to allow trainees to speak freely and engage in open discussions
    b. Through training.

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i. Rather than telling researchers what to do during training, focus on giving awareness of RI standards and best practices, as well as enthusiasm and support to act with integrity

Explanation: This item was discussed in the first set of workshops, but under the subtopic 'post-doctorate RI training'. We added it to this subtopic as well, as it also applies here. Participants' rationale for including this item was that "education and 'good' research culture have to be hand in hand", since they influence each other. This was supported by the SoRs. Furthermore, item 6bi was added based on a comment in the second set of workshops that RI training should not be about telling researchers what to do but rather giving them the means and tools to act responsibly, to create a collaborative and healthy environment.

Best practice examples:

- Research integrity training program at University College London: https://www.ucl.ac.uk/research/integrity/research-integrity-training-framework
- Committee on publication ethics resources: https://publicationethics.org/core-practices
- 'Science in action' course at University Pompeu Fabra: https://www.upf.edu/web/phd-biomedicine/science-in-action
- Editage educational resources: https://www.editage.com/insights/
- Stockholm University's 'Research ethics for human sciences' course: https://www.su.se/department-of-philosophy/education/courses-and-programmes/research-ethics-for-human-science-1.523153?eventopenforinternationalstudents=true&q=&xpanded=

Additional remarks: The best practice examples above were mentioned by participants in the second set of workshops. There are likely many other best practice examples available, which can be added to the list here.

Participants also mentioned some implementation considerations for these guidelines in the second set of workshops including that:

- *The guidelines are already well developed.*
- *Targeting young researchers is helpful as they are the future of research and they will mentor future young researchers*
- *It would be optimal to start RI training already at the high school level, as students are first acquainted with research at that level*
- *Top down support for the guidelines is necessary for implementation*
- *Measuring training effectiveness is difficult.*
- *Supervisors and mentors play an important role in RI training*
- *The purpose of RI training has to be clear to everyone for implementation*

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- *A balance is needed between supporting bottom up initiatives and providing top down support, but is difficult to achieve*
- *It might be difficult to account for disciplinary differences in general RI training courses*
- *Training should start with general issues and move to specifics later*
- *Follow up formal and informal training is difficult to coordinate and organize*
- *Standardized terminology should be used in the guidelines to ensure everyone understands all concepts*

Research integrity training for post-doctorate and senior researchers

Title of skeleton guidelines:

Guidelines on post-doctorate research integrity training for research institutions

Guidelines:

1. **Deliver mandatory training about research integrity basics for researchers with a doctorate starting a new position.**
    a. As part of the introduction package for new employees
    b. Include existing employees starting a new position at the same institution in the training
    c. Recap the basics of research integrity in this training
    d. If the researchers have not yet obtained research integrity training at the PhD level, ask them to follow a PhD research integrity course as well.
    e. Employ trainers with general expertise in research integrity or collaborate with trainers in other institutions
    f. Supplement the mandatory trainings with follow-up peer support meetings.

Explanation: Participants in both sets of workshops explained that in order to ensure that all post-doctorate researchers receive RI training – rather than only those who are interested in RI in the first place – it is important to deliver mandatory RI training. For feasibility purposes, they suggested to mandate the training to incoming researchers and those who start new positions (i.e. are promoted) at the institution (items 1a and 1b). Items 1c and 1d were brought up in the second set of workshops, as a means to ensure that all post-doctorate researchers have sufficient background in the basics of RI. Items 1e was based on participants' suggestion in the firs set of workshops that the most suitable person to deliver the mandatory training would be someone with general knowledge about RI, rather than someone with more specialized knowledge (e.g. about data management). In the second set of workshops, some participants were concerned that not all institutions might be able to employ their own trainers; therefore item 1e offers some flexibility and guides institutions with less resources to collaborate with other institutions or trainers. The last item (item 1f) was onluy discussed in the first

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set of workshops; participants highlighted that peer support meetings could be very helpful and feasible ways to ensure continuous RI learning.

2. **Follow up with mandatory specialized trainings every 2-3 years at all post-doctorate levels.**
    a. Use small events, like half-day workshops, rather than full courses.
    b. Provide or refer trainees to easily accessible online modules with specialized content.
    c. Employ trainers with specialized expertise or collaborate with trainers in other institutions.

Explanation: In the first set of workshops, some participants suggested that in order to keep up with the newest regulations and policies and refresh researchers' knowledge and skills about RI, it would be helpful to offer optional follow up training events, focusing on specific RI issues (e.g. data management). However, in the second set of workshops, many of the participants preferred to make the follow-up training events obligatory, to ensure that all researchers are up-to-date on RI. These participants thought that a 2-3 year interval between trainings would ensure that these follow-up events are not burdensome. Furthermore, they suggested to keep the training events small, also to reduce the burden (item 2a). Item 2b was discussed in both sets of workshops. Item 2c was brought up in the first set of workshops, and slightly modified after the second set of workshops where some participants were concerned that not all institutions will have the means to hire their own trainers.

3. **Use blended-learning formats**
    a. Ensure that trainees can turn back to training to look at the content later
    b. Discuss case studies, but with a focus on positive aspects of research integrity rather than research misconduct.

Explanation: Item 3 was only discussed in the second set of workshops for this guideline, and therefore recently added. Due to participants' suggestions that many of the items in the pre-doctorate training guideline also apply to this guideline, we added item 3a here to ensure some consistency. Item 3b was discussed in the second set of workshops.

4. **Encourage and support the organization of informal discussions at departments or research teams to supplement formal training**
    a. Mix junior and senior researchers in some of these sessions
    b. Foster multidisciplinary discussions

Explanation: This item was raised in the first set of workshops, where many participants highlighted the importance of sharing experiences and problems in informal meetings for RI education. It was slightly altered in phrasing from 'Organize informal events' to 'Encourage and support the

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organization of informal discussions' to take into account some concerns raised by a few participants in the second set of workshops, that organizing informal discussions can be difficult to coordinate and arrange. Item 4a was taken from the guidelines on pre-doctorate training, as it also seems to apply here. Item 4b was based on discussions in both sets of workshops as many participants stressed that having multi-disciplinary RI discussions is especially useful as much of research today is multidisciplinary. After the first set of workshops, item 4b was a main item but we eventually decided to place it as a sub-item under item 4 based on the suggestion of one of the participants of the second set of workshops that this should not be a main heading, and the suggestion of another participant that multidisciplinary concerns are especially interesting to discuss in informal discussions.

5. **Teach post-doctorate and senior researchers about research integrity by asking them to teach about the topic at the pre-doctorate level**

Explanation: Item 5 was included based on the results of the first set of workshops, where it was discussed that when post-doctorate researchers have to deliver RI training, it is a means for them to progress in their own RI education as well. However, in both sets of workshops, and especially so in the second set, there was hesitancy about the usefulness of this guideline as many participants were afraid that if post-doctorate researchers are not sufficiently trained in RI and enthusiastic about it to begin with, it would be risky to ask them to train more impressionable junior researchers.

6. **Motivate trainees to actively participate in training**
    a. Convey clearly that research integrity is important for research quality and relevant for all researchers.
    b. Label trainings as 'Masterclass' rather than 'training' to make them more attractive.
    c. Do not label trainings with normative titles such as 'research integrity', but rather use more relatable and neutral terms
    d. Integrate research integrity trainings into existing courses
    e. Link research integrity and research integrity training to funding, promotions, ethics review, etc.
    f. Highlight the importance of research integrity training in preventing reputational damage.

Explanation: This point was highlighted in the SoRs and extensively discussed in both sets of workshops. It was repeatedly emphasized by many participants motivating trainees is especially difficult at the post-doctorate level, so this needs a lot of attention in the guideline. Initially the item was named 'Incentivize training', but a participant in the second set of workshops suggested that 'incentive' is not appropriate to use when we discuss mandatory training, suggesting that 'motivating trainees' is more appropriate. Item 6a was raised in the second set of workshops, while items 6b, 6e-6f were raised in the first set of workshops, and items 6c-d originate from the SoRs.

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7. **Employ respected, enthusiastic and qualified trainers**
    a. Employ a set of trainers to ensure expertise in all aspects of RI are covered (e.g. ethics, data management, open science, etc.)
    b. If possible, select trainers from inside the institution.
    c. If not possible to hire internal trainers, collaborate with trainers or training programs from other institutions
    d. Involve senior peers in the training delivery

Explanation: Just like for the guidelines on pre-doctorate training, participants in both sets of workshops discussed the importance of hiring suitable trainers for RI training of post-doctorate trainees. As such, this item mirrors the item on suitable trainers for the pre-doctorate training guideline. Item 1a arose because some in the second set of workshops mentioned that a team of trainers with different types of expertise might be needed. Items 1b and 1c are based on insights from the second set of workshops about how internal trainers are most suitable since they know the local context best, but that it might not always be possible hire these. Item 1d is from results of the first set of workshops, where some participants suggested that it can be helpful to have senior colleagues deliver the trainings, to show support for RI and illustrate its importance for practice.

8. **Tailor the trainings to the needs of the trainees:**
    a. Conduct a training needs analysis (TNA) to learn about your target groups' needs and tailor training accordingly
        i. Senior post-doctorate researchers might need a different training strategy than more junior ones.
    b. Plan meetings with researchers, to discuss what should be covered during training and tailor training accordingly
    c. Address cultural differences in the understanding of RI in training.
    d. Give researchers the space to share stories and challenges.
    e. Address all roles of good researchers in training including mentorship, reviewing, leadership, etc.
    f. Have follow up meetings with researchers to discuss how to integrate research integrity considerations into their research
    g. Ensure that training has an added value to trainees and communicate this value clearly (e.g. helping with grant application success)

Explanation: The need to use a bottom up approach for training was highlighted in both sets of workshops for the guidelines at the post-doctorate level. Item 8ai was already brought up in the first set of workshops, but the idea to do a trainings needs analysis and hold meetings with trainees to discuss what to include in training (items 8a-8b) was brought up by some participants in the second

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set of workshops. Similarly, items 8f-8g were also brought up in the second set of workshops. Items 8c-8d were based on insights from the first set of workshops, while 8e was adapted based on a recommendation in the SoRs that the role of the reviewer should also be addressed in training.

9. **Evaluate training programs**
    a. Use subjective measures (e.g. trainees' perception of training usefulness)
    b. Use follow up measures (e.g. number of participants enrolled in optional training)

Explanation: For this guideline, evaluation was not discussed in the first set of workshops. Instead, we integrated this item from the SoRs phrased initially as 'Evaluate training effectiveness using appropriate measures'. However, the participants in the second set of workshops discussed how evaluating 'effectiveness' of courses through objective means is difficult and maybe not even possible. Therefore, they suggested to evaluate training based on subjective means (item 9a) or on simple objective measures not related to effectiveness (item 9b). Therefore, we reformulate this entire item in the guideline to remove the word 'effectiveness' and add some flexibility in how training programs can be evaluated.

10. **Foster a positive research culture**
    a. As a prerequisite for training, to allow trainees to speak freely and engage in open discussions
    b. Through training
        i. Rather than telling researchers what to do during training, focus on giving awareness of RI standards and best practices, as well as enthusiasm and support to act with integrity

Explanation: Participants' rationale for including this item was that "education and 'good' research culture have to be hand in hand", since they influence each other. This was supported by the SoRs. Furthermore, item 10bi was added based on a comment in the second set of workshops, that RI training should not be about telling researchers what to do but rather giving them the means and tools to act responsibly, to create a collaborate and healthy environment.

Best practice examples:

- Data management seminars for senior researchers
- Small research integrity workshops
- Marie Curie research integrity programs for postdoctoral researchers: https://www.mariecuriealumni.eu/topics/research-integrity
- Ghost, as a way to evaluate courses: https://ghost.org/

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Additional remarks: The best practice examples above were mentioned by participants in the second set of workshops. It is unclear whether there are other best practice examples available; it would be helpful to look for these further.

Participants also mentioned some implementation considerations for these guidelines in the second set of workshops including that:

- *Mandatory training can lead to a box-ticking mentality*
- *It is more difficult to make courses mandatory at the post-doctorate level compared to the pre-doctorate level*
- *Funders can help to incentivize RI training by requiring it*
- *It is difficult to focus on concrete research practice, rather than ethical theory, in general RI training since each discipline has different practices*
- *Evaluating training effectiveness through objective measures is difficult.*
- *Standardizing RI training at the post-doctorate level across Europe is difficult when there are no/few formal courses available*
- *Many of the items mentioned in the pre-doctorate RI training guidelines have been added here as they also apply for this target group.*

Training of research integrity personnel & teachers

Title of skeleton guidelines:

Guidelines on training of research integrity personnel & teachers for research institutions

Guidelines:

1. **Organize formal and/or informal events where personnel from various departments are brought together to share roles, experiences, and discuss how to work together on research integrity.**
    a. Include: research integrity committee members, data management personnel, legal staff, library staff, research integrity trainers, researchers, policy and management staff, confidential counselors, etc.
    b. Ensure that staff address the relevant skills needed for their role.
        i. Research integrity officers/committee members should address skills relevant for responsibly investigating allegations of misconduct.
        ii. Confidential advisors/counselors/ombudspeople should address facilitation, mediation and interpersonal skills.
    c. Discuss case studies, relevant for the institution, to learn from each other.
        i. Less experienced staff should be presented with possible cases they might face.

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ii. More experienced staff can present their own cases and discuss how they have dealt with them.

d. Help staff understand researchers better

e. Face-to-face trainings are more suitable here, but online sessions can be used to supplement the face-to-face components.

Explanation: This item was discussed in the first set of workshops and was initially phrased as: 'Provide trainings, where personnel from various departments at the institution are brought together to share roles, experiences, and discuss how to work together'. The rationale behind the item was that bringing various support staff together to discuss questions, cases and experiences would be very informative and help staff to work better together. In the second set of workshops, a participant explained that the term 'training' might not be appropriate here, considering that a more informal event might be more suitable for this type of peer exchange of knowledge and experience rather than 'training' which involves a more top down approach to education. The participant even mentioned that it is not suitable to discuss hiring official trainers for this target group – an additional item that we had put in the earlier version of this guideline, which we then deleted. To further account for this view, we reformulated item 1 to exclude the word 'training' and explicitly mention that the exchange can occur in a formal or informal event, leaving room for flexibility in implementation. In line with this, we also reformulated item 1b which was initially phrased as 'Teach staff the relevant skills', to ensure 'Ensure that staff address the relevant skills'. In the earlier draft of this guideline (after the first set of workshops), item 1a was also partially mentioned as a separate item as 'Include researchers in the training', but we removed that item due to redundancy. The rest of the points under this item arose either directly from the first set of workshops (items in black) or the SoRs (items in blue).

2. Ensure that research integrity trainers are provided with train-the-trainer training by referring them to existing training programs or developing an in-house training.

a. Ensure that trainees learn about the foundations of research integrity and ethical theory

b. Ensure that trainees are taught about training methods.

Explanation: In the first set of workshops, some participants stressed that specific training is needed for trainers of RI, where both RI basics (item 2a) and training methods (item 2b) are taught. In the second set of workshops, there was agreement about the importance of the item, but some participants expressed concern that not all institutions will be able to provide their own train-the-trainer RI training. To account for this, after the second set of workshops, we formulated item 2 as 'Ensure that RI trainers are provided with… by referring them to existing training programs or developing an in-house training' (rather than the previous formulation of 'Provide RI trainers with…),

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and item 2b as 'ensure that trainees are taught' (rather than the previous formulation of 'Teach trainees about training methods').

3. **Provide multidisciplinary trainings where disciplinary considerations can be discussed**

Explanation: Participants in both sets of workshops agreed on the inclusion of item 3, as they mentioned that many types of research considerations are relevant for multiple disciplines (e.g. ethical considerations related to research with humans are the same across many disciplines).

4. **Organize training events regularly, with new trainings offered at least when policies/regulations/infrastructures change.**
    a. Use examples and cases to illustrate new policies, regulations, and/or infrastructures

Explanation: This item was discussed in both sets of workshop as important to include to ensure that staff are aware of the most updated policies/regulations and infrastructures. Item 4a was added based on some participants' suggestions in the second set of workshops that policies and regulations are often boring, and need to be 'brought to life' using interesting cases and examples.

5. **Facilitate the formation of European level support groups about research integrity to support peer-to-peer learning.**
    a. Facilitate participation in online seminars and workshops
    b. Facilitate the sharing of institutional resources with others.

Explanation: The usefulness and importance of European level support groups for RI staff was highlighted by participants in both sets of workshops, as was the sharing of institutional resources with others (item 5b). Item 5a was added due to some suggestions in the second set of workshops that online events are especially helpful to deal with problems with mobility across countries.

6. **Commit strongly to research integrity training, also for staff**
    a. Include research integrity/ethics as a central aim of the institution
    b. Highlight the intrinsic (e.g. improved research quality) and extrinsic (e.g. in relation to grants) importance of research integrity for research

Explanation: Item 6 is more of an implementation issue for the guideline, rather than a point directly related to the training of RI staff. However, it was mentioned as a point to include in the guideline in both the first and second set of workshops, since many participants exclaimed that without top down

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support, the guideline would not work. Items 6a and 6b were additions made in the second set of workshops, to help make the overall item more concrete.

7. **Evaluate training programs**
    a. Use subjective measures (e.g. trainees' perception of event usefulness)
    b. Use follow up measures (e.g. number of participants in an event)

Explanation: For this guideline, the item on evaluation – item 7 – was brought up by two participants in the second set of workshops, who stressed that evaluation of training programs for RI personnel & teachers was just as valuable as for other target groups. Therefore, we added this item to this guideline and formulated it in the same way as for the guidelines on RI training for pre-doctorate and post-doctorate researchers.

8. **Reward RI teachers and support personnel for their work**
    a. Reward the involvement of support staff, recognise their involvement in teaching RI in their career assessments, and appreciate their work.
    b. Reward researchers who also take on RI support roles (e.g., confidential advisors, ombudsperson, etc.).

Explanation: This item and its subpoints were brought up in the first set of workshops, and there was agreement on its importance in the second set of workshops. Although the item is not directly about training, it is important issue that is likely to have a significant influence on the implementation of this guideline.

Best practice examples:

- ERION: https://www.earma.org/about/governance/thematic-groups/ethics-and-research-integrity-officer-network-erion/
- EU project Recaphe: https://recaphe.eu/
- EURASHE: https://www.eurashe.eu/
- EURAXESS: https://euraxess.ec.europa.eu/

Additional remarks: The best practice examples above were mentioned by participants in the second set of workshops. There are likely many other best practice examples available, such as materials from the VIRT2UE project, which can be added here.

Participants also mentioned some implementation considerations for these guidelines in the second set of workshops including that:

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- *It is less suitable to use the word 'training' for this target group, as exchange of knowledge is more suitable here rather than top down training*
- *Top down support is crucial for the implementation of this guideline*
- *Making RI a central strategy of the institution will ensure that sufficient time, resources and personnel are allocated to its implementation.*
- *Evaluating training programs is difficult*
- *COPE can help SOPs4RI with organizing European-level webinars*
- *Piloting the guidelines would be very helpful*
- *These guidelines are already well-developed.*

RI counseling and advice

Title of skeleton guidelines:

Guidelines on research integrity counseling & advice for research institutions

Guidelines:

1. **Appoint trustworthy trained official confidential counselors, familiar with research, whom researchers can turn to in case of doubts or questions per department or research teams.**
    a. Ensure that counselors are knowledgeable about all relevant policies and guidelines at the international and local level
    b. Have higher management endorse the trustworthiness of the counselor.
    c. A clarification should be given on what researchers can and cannot expect from this contact person.
    d. Set up a procedure for handling conflicts of interest relating to the role of the confidential counselor.

Explanation: *This item was raised in the first set of workshops, and expanded on in the second set of workshops. Items 1a-1b, and 1e were discussed in the second set of workshops. Items 1c and 1d are integrated from the SoRs. Initially, we had also put another item under here, as an outcome of the first set of workshops, stating that institutions should 'clearly communicate to researchers that counseling is confidential'. However, a participant in the second set of workshops mentioned that in some countries, confidentiality cannot always be guaranteed as counselors might have a legal obligation to report misconduct cases. Therefore, we removed that item, and hope to have further addressed this concern under item 1d (from the SoRs).*

2. **Research institutions should provide researchers with contact persons for advice on specialized/domain specific RI issues (e.g. privacy officers, librarians, etc.)**

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Explanation: This item was not discussed in the first set of workshops, but was integrated into the guidelines from the SoRs. In the second set of workshops, participants mentioned that they did not see the difference between this item and the previous one on confidential counselors. However, we decided to keep this item because it is rather different from item 1, which is about general RI counseling, as it is focused on specialized RI issues which general RI counselors might not have sufficient expertise in. To highlight this, we now provide some examples of specialized RI contact persons in the item, i.e. privacy officers, librarians, etc.

3. **Ensure that needed advice is provided in a timely manner and with sufficient follow-up.**

Explanation: Some participants in the second set of workshops mentioned that the guideline was missing some information about what the institution should require about the quality of the counseling provided. Item 3 was added to address this point. Some participants explicitly stated that good counseling is timely and provides sufficient follow up.

4. **Recruit volunteers to be research integrity stewards and to act as informal 'firstresponders' to researchers with research integrity questions, in order to guarantee that researchers have access to low-threshold counseling.**
    a. Ensure that the volunteers are sufficiently trained in research integrity, although they do not need to have undergone official training specifically targeted at counselors.
    b. Harmonize the work of data stewards and RI stewards

Explanation: This item was addressed in both sets of workshops and the SoRs. In the second set of workshops, one participant explained that volunteers also need sufficient training in RI, while others asked for more coherence between the work of data stewards and RI stewards (items 1a and 1b).

5. **Set clear roles and responsibilities for different bodies/persons involved in counseling & advice**
    a. Communicate clearly what the legal responsibilities of each body/role are (e.g. reporting on cases of misconduct)
    b. Do not overburden research integrity staff with too many roles (e.g. teaching and handling cases)

Explanation: To prevent RI staff from becoming overburdened and to make it clear and transparent what their different roles and responsibilities are, participants in the second set of workshops suggested to add item 5 to the guideline.

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6. **Ensure that the counselors and research integrity stewards are visible, approachable and easy to find.**
    a. Provide information and contact details of counselors and research integrity stewards on the institutional website.
    b. Balance visibility with secrecy: Ensure that those approaching the research integrity counselors and stewards can do so without being noticed

Explanation: There was agreement in both sets of workshops on the importance of item 6. Some participants in both workshops brought up item 6a, while one participant in the second workshop raised the issue of balancing visibility with secrecy (item 6b).

7. **Provide researchers with resources they can consult to prepare for counseling sessions.**
    a. Refer researchers to a European level online helpdesk containing general information on research integrity.

Explanation: In the first set of workshops, participants mentioned that institutions should provide researchers with an online helpdesk which answers simple questions. However, in the second set of workshops, participants were concerned that this would not be feasible for each institution since it would require significant amount of resources. Additionally, some participants in the second set of workshops expressed that simple questions do not exist, as all RI questions they have experienced are context specific and complex. These participants suggested that rather than providing researchers with an institutional helpdesk to address in case of questions, institutions should refer researchers to existing resources that can help them prepare for counseling sessions so that they come to sessions more prepared. On the other hand, a few participants suggested that a helpdesk would be very valuable for 'simple questions', but on a European level rather than an institutional level. We have reformulated this item now to include both perspectives (referral to existing resources and to a European level helpdesk).

8. **Have a strong institutional commitment towards providing RI support.**
    a. Include research integrity/ethics as a central aim of the institution
    b. Mandate the implementation of the guideline
    c. Hold open forums with researchers to explore their needs
    d. Allocate sufficient resources and time to counselors, both reactively and proactively.

Explanation: Item 8 is more of an implementation issue for the guideline, rather than a point directly related to RI counseling and advice. However, it was mentioned as a point to include in the guideline in both the first and second set of workshops, since many participants exclaimed that without top down support, the guideline would not work. Items 8a- 8c were additions made in the second set of

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workshops, to help make the overall item more concrete. Item 8d was raised in the first set of workshops.

9. **Include counselors & support staff in policy and education, so that counseling can improve policy and education and vice versa.**
    a. Co-create institutional policies together with the counselors and support staff
    b. Counselors should report on the types of cases they receive to use for education and policy

Explanation: There was agreement about the importance of item 9 in both sets of workshops, since participants mentioned that counseling, policy and education are interrelated and counselors can play a role in helping to align these. However, based on how it is interpreted, this point could be seen to clash with item 5b (not overburdening counselors) in the guideline. Items 9a and 9b were additions made in the second set of workshops to make the overall item more concrete.

10. **Offer people in support roles the possibility to progress in their career, for instance by involving them in executive decisions of the institution**

Explanation: Item 8 is more of an implementation issue for the guideline, rather than a point directly related to RI counseling and advice. Some participants in the first set of workshops emphasized that to ensure good quality counseling, institutions should ensure that counselor are able to climb the career ladder. However, some participants in the second set of workshops questioned the feasibility of this item as it would require a significant budget and resources. A suggestion was made by one of these participants to deal with this feasibility issue by increasing the decision making weight of the counselors, rather than necessarily creating new positions for them. The current formulation of item 10 takes is an attempt to merge these important considerations.

Best practice examples:

- Ghent university trust point where confidential counselors and RI officers meet with researchers to discuss things

Additional remarks: The best practice examples above were mentioned by participants in the second set of workshops. There are likely many other best practice examples available which can be added here.

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Participants also mentioned some implementation considerations for these guidelines in the second set of workshops including that:

- *Support from the institutional leadership is needed for the implementation of this guideline*
- *Despite the importance of the previous point, to ensure that researchers make use of counseling & advice services offered at the institution, counseling & advice should not just be seen as an extension of the executive board but rather as something that meets the needs of researchers.*
- *In some countries, confidential counselors have a legal duty to report on misconduct cases*
- *RI officers do not have the power to influence many of the items in this guideline (e.g. allowing people to climb the career ladder)*
- *To help implementation, it would be helpful to co-create the institutional policy on counseling and advice together with the community using a bottom up approach*
- *Budget constraints are important for this guideline.*
- *COPE might be interested in helping SOPs4RI develop a European level RI helpdesk.*

4.2.1.2. Mentoring and supervision

PhD guidelines

Title of skeleton guidelines:

Guideline for PhD mentoring and supervision in research institutions

Guidelines:

The institute will install support mechanisms for supervisees to foster a good relation between the supervisors and supervisees

1. **Develop a document for PhD students containing essential information about the PhD trajectory, including institutional rules, the rights and responsibilities of the PhD student**
    a. Communicate essential information of rights and responsibilities, rules and deadline policies to all PhD students
    b. Communicate how and when PhD students should inform their supervisor in case of problems or challenges.
    c. Communicate the expected workload of a PhD.
    d. Include information on the ethical considerations and practicalities pertaining their projects.
    e. Ensure that students know contacts of institutes' ombudspeople or other relevant persons at the institute

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f. Inform students about how a good research culture can be built and maintained
g. If applicable, refer to national and international codes of conduct

Explanation: Guideline 1.1 is the result of the clustering exercises in the first workshop, where the emphasis lay on communicating institutional guidelines to PhD students, and where students should be made aware of the guidelines. This was mentioned by both groups. The main recommendation was rephrased based on the insights from workshop round 2, the critique from participants was to not overburden PhD students with responsibilities. Guideline 1a and 1b were selected from the SORs. Guideline 1c and 1d were the result from the creating and clustering exercises of workshop round 1. Guideline 1e was based on the SORs, and the second part was added . Guideline 1f and 1g were based on the analysis of workshop 2, and aim to integrate emphasizing a good research culture. One guideline was moved to guideline 1.5 "Maintain a communication policy that allocates time specifically for addressing needs of PhDs." as it fit that specific sub-topic better.

2. Provide adequate support and training for PhD students.

a. Host supervision seminars or provide training to PhD students on responsible supervision and mentoring
b. Create extra support mechanisms to reach and support foreign and guest students
c. Ensure tailoring support to meet the needs of individuals is possible
d. Train PhDs to become aware of good supervision by creating opportunities for them to supervise more junior students in their research projects (e.g., Master students)
e. Use trainings as an opportunity to increase students' awareness of their own needs

Explanation: Guideline 1.2 is the result from the creating and clustering exercises from workshop 1. Both groups mention support and training. In guideline 2a the second part of the guideline is removed, as it is too much off-topic. Guideline 2b and 2c were added as a result of the analysis of workshop round 2. Guideline 2d and 2e were added as a result of the SORs. Facilitate peer support groups for PhD students: PhDs for/to PhDs

a. Set up a PhD community to foster interaction among PhDs between disciplines and across disciplines
b. Incentivize students to set up formal and informal peer-to-peer support groups – between PhD students,
c. Organize events where former PhD students can share practical advice and tips with current students
d. Communicate the peer-to-peer support structures to students, make the peer support visible and approachable.

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Explanation: Guideline 1.3 is the result from the content creating and clustering exercise from workshop round 1. One group explicitly mentioned peer support, where the other group mentioned collaboration between PhDs; of which the recommendations were placed under point 1.3 Guideline 3a was edited to make the guideline more concrete and feasible. Guideline 3b is from an insight of workshop round 1, the second part is removed to reduce redundancy (and between (old) PhD students to share tips and problems). Guideline 3c is from workshop round 1. Guideline 3d is a new insight from workshop round 2. One guideline was removed because of redundancy with guideline b (Facilitate interdisciplinary discussions in small groups).

3. **Provide an independent body that students and supervisors can turn to in case of problems.**
    a. Responsibilities of internal and external bodies need to be clearly defined to handle conflicts and problems
    b. For small research institutes and small research groups, providing independent bodies can be valuable
    c. Ensure student counsellors or ombudspersons are approachable and visible for students to turn to when facing problems with their supervisors

Explanation: Guideline 1.4 is based on the clustering exercises from workshop round 1. A conflict was identified during the analysis of workshop round 2, where the usefulness of independent bodies was questioned. Based on this conflict, guideline 4b was developed; as it was stressed independent bodies are especially important for small institutes. However, a gap remains in whether the independent body can only be an 'external' body, or can also be internal. Guideline 4a was developed based on the discussion on how the responsibilities should be defined. One possible solution is to leave open the possibility of having an internal or external body to turn to. And leave it up to the institutions: an ombudsperson or confidential counsellor who includes this as their responsibility could already help – this was mentioned in the topic research environment & training. For small institutes an 'external' body could be more valuable. For large institutes an 'internal' body could be sufficient. Guideline 4c was included after reanalyzing the first workshop data, a student counsellor was mentioned in the poster, but having a student counselor or ombudsperson was 'lost' in drafting the skeleton guidelines.

4. **Create and implement support structures for the well-being, care and mental health issues of students**
    a. Ensure the support structures for well-being, care and mental health are visible and approachable for all students
    b. Assist PhD students in understanding and respecting their own needs.
    c. Facilitate interdisciplinary student discussion groups to discuss the students well-being, self-care and mental health issues

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d. Maintain a communication policy that allocates time specifically for addressing needs of PhDs.

Explanation: Guideline 1.5 was included based on the clustering and exercises from workshop round 1, based on the analysis and the quotes of the participants. Mental health issues were added after workshop round 2. Guideline 1a was rephrased after workshop round 2 to fit better feasibility (previously Ensure students know where to go when they face problems). Guideline 5b needs to be clarified in terms of the following comment from a participant on the guidelines: 'I think this will become much more powerful if you can add means how to do that – training/courses? Coaching from someone not linked to the project? Human resource department?'. This is currently an implementation issue. Guideline 5c was the result from workshop round 1, where discussing problems and issues with peers was considered beneficial, after round 2 this was explicated to fit the sub topic and improve feasibility. Guideline 1.5d was previously in guideline 1, but fitted better in guidelines 5. One implementation issue is that this guideline needs to be made more concrete. Two subtopics were was removed because of redundancy with 1.3b. (Provide both formal and informal settings for communication between students.) and 1.5c (Provide peer support possibilities out of one's own social group).

5. **Develop a procedure to change supervisors or terminate a PhD-trajectory**
    a. Have a mechanism, policy or procedure in place to change supervisors
    b. have a mechanism, policy or procedure in place to terminate a PhD-trajectory

Explanation: Guideline 6 was developed based on insights from workshop round 2. Guideline 6a and 6b and reflect the discussion on having the possibility to change supervisors and terminate a PhD. Guideline 6c reflects the comment of one participant to have an external board determine changing supervisor or terminating a PhD.

The institute will foster a good relation between the supervisors and the PhD student by implementing the following:

6. **Require supervisors and PhD students to sign agreements regarding supervision in an early stage of the career trajectory**
    a. The written agreement on supervision centers around creating good cooperation between the supervisor and supervisee
    b. The agreement discusses differences in expectations and maintaining transparent communication.

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c. The agreement sets common understanding on expectations, requirements, roles, responsibilities to address and incentivize not only practical issues, but also social relationships
d. The institution should keep a retrievable record of the agreements

Explanation: Guideline 7 is the result from the content creation and clustering exercises from workshop round 1. One group stated the importance of setting agreements between the PhD candidate and supervisor. Guideline 7a is the result of an identified conflict between participants in the second set of workshops, where written agreements could be perceived as hostile if they are used as legally binding documents. The word binding is also removed from guideline 7, to address the conflict. Guideline 7b is included based on the insights from workshop round 1. Guideline 7c is rephrased to further explain what should be in the agreement. Guideline 7d is a revised recommendations from the SORs, where the institutions (rather than solely the student) should be responsible for keeping a record of the agreement, based on the insights of a comment from a participant.

7. Create a space for the exchange of ideas between supervisors and PhDs.

a. Make periodical meetings between supervisors and supervisees mandatory
b. Provide opportunities for feedback, ideas and experiences.
c. Organize peer group discussions with students and senior researchers.
d. Facilitate discussions between individuals from different disciplines.
e. Encourage PhDs to ask for guidance in complying with policies and procedures and facilitate this process.
f. Provide constructive feedback sessions oriented towards supervisors.
    i. Integrate the above into annual review meetings.

Explanation: The initial guideline 8, which initially proposed to "Set requirements for responsible supervision and mentoring (and communicate them to PhD students)" has now been moved to other items. This item was the result of the discussions of workshop round 1. However, to decrease redundancy this topic and their subtopics have been moved to guideline 2.6 – set requirements for supervision. Guideline 1.8a is moved to 2.1.c. Guideline 1.8.b is moved to 2.6.b. Guideline 1.8.c is deleted due to redundancy in 1.1.a. And guideline 1.8.d is deleted due to redundancy with 1.5.f. This in order to reduce the responsibilities for PhD students, which was mentioned as an issue by the participants in workshop round 2 (they are not responsible for the subtopics under this guideline) and to reduce redundancy.

The new Guideline 8 is the result of the content creation and clustering exercises of workshop round 1. Guideline 8b, 8c and 8d are the result of workshop round 1. Recommendation 8e and 8f are based on the SoRs. Guideline 8a is based on the insights of workshop round 2.

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Best practice example:

- Provide an PhD students with an independent mentor with whom they can meet once a year
- In cases where PhD students wish to change supervisors or terminate their PhD, have an external board draw up a conclusion on the requests.

Supervision requirements and guidelines

Title of skeleton guidelines:

Guideline for supervision requirements and guidance in research institutions

Guidelines*:*

1. **Ensure that supervisors have sufficient time for supervising research**
    a. Allocate official research time to all doing research, including e.g. clinical researchers
    b. Allocate official supervision time to all supervisors of research
    c. Limit the number of PhD students per supervisor

Explanation: Guideline 1 is the result of workshop round 1. No new insights were given in workshop round 2, however, the importance of sufficient time was stressed again, also as an implementation issue.

2. **Provide supervisors with the necessary support structures needed to supervise**
    a. Provide and disseminate clear rules, guidelines and procedures about supervision
    b. Set-up a body to periodically evaluate supervision and provide feedback
    c. Facilitate supervisor commitment to their supervisees
    d. Provide structures and policies which place a stronger focus on negative results and replication studies
    e. Set-up supervisor peer-support systems to ensure that supervisors also have someone to turn to for advice and support regarding supervision.
    f. As an institution, support and engage in research on supervision
    g. Co-supervisors can support each other in supervision tasks
    h. Implement a communication policy between supervisors and higher management levels to ensure good cooperation between all parties, and setting expectations on roles and responsibilities regarding good supervision

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Explanation: Guideline 2.2 is the result of workshop round 1. Guideline 2a and 2b are from workshop round 1.. Guideline 2c and 2d should be further explored for implementation. Guideline 2e and 2f are from the SORs. Guideline 2f could be a more general recommendation to institutions, rather than a support structure for supervisors. Guideline 2g and 2h are from workshop round 2. Guideline 2i is covered in guideline 2.3, to be removed for to decrease redundancy (Provide training and supervision seminars)

3. **Provide obligatory training on supervision to all supervisors**
    a. Implement repeated supervision training to ensure continued learning as a supervisors to keep skills and knowledge up to date
    b. Include a broad range of skills in the training, including skills to ensure that supervisors learn how to listen and communicate
    c. Involve more experienced supervisors in the training of less experienced supervisors

Explanation: Guideline 2.3 is the result from the content and clustering exercise from workshop round 1. Guideline 3a was revised based on the analysis of workshop round 2, to ensure continuity of training. Guideline 3b and 3d were added as new insights. Guideline 3c reflects the discussion in workshop round 1.

4. **Promote a positive research environment which fosters good supervision**
    a. Promote and implement a positive error culture, where individuals are allowed to make mistakes
    b. Value supervision as an important part of the research endeavor
    c. Use trainings as a tool of fostering culture change
    d. Promote an 'open door culture', where supervisees perceive a low barrier to contacting their superiors and other colleagues

Explanation: Guideline 2.4 reflects the discussion of workshop round 1. Guideline 4a, 4b and 4c are the reflections from round 1, guideline 4d a new insight from round 2. Guideline 4a was revised based on the comments from participants in workshop round 2.

5. **Facilitate a positive interaction between students and supervisors**
    a. Let supervisors and supervisees tailor the interaction between them
    b. Facilitate discussions, open and direct communication, between supervisors and supervisors
    c. Promote an 'open door culture', where supervisees perceive a low barrier to contacting their supervisors – both offline and online

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d. Ensure regular meet-ups, especially at the start of the PhD, between the supervisor and supervisee and provide supervisors with guidance on what to discuss with supervisees, e.g.
    i. Establish standards for research
    ii. Teach students about best practices
    iii. Provide students with constructive feedback
    iv. Support students in all phases of their research (i.e., also when they obtain disappointing results)
    v. Ask about their well-being and perceived problems, including asking questions whether they feel alone in the process
    vi. Acknowledge the academic accomplishments of supervisees
    vii. Engage in open and responsive communication with the PhD student about questionable research practices

Explanation: Guideline 2.5 is the result from workshop round 1. Guideline 5.1a was revised, and preventing students from becoming lonely was placed under 5e; to make sure not too much responsibility concerning well-being of students is placed on the supervisors guideline 1b (open and direct communication) was combined with facilitation of discussion, as this was perceived as quite a similar recommendation. Guideline 5c is rephrased to reflect the discussion from workshop round 2. Guideline 5d reflects the discussions in workshop round 1, and is rephrased based on the analysis of workshop round 2. The sub-points reflect both the workshop in round 1 (point i-iii), the SoRs (v-vii) and the earlier mentioned point about guideline 1a.

6. Set requirements for responsible supervision

a. Provide supervisors with concrete examples of good supervision
b. Require supervisors to meet with their supervisee regularly
c. Where possible, assign multiple supervisors per PhD student
d. Provide supervisors with a list of requirements to meet as supervisors, such as:
    i. Familiarity with PhD procedures
    ii. Ensuring that supervisees are aware of PhD procedures
    iii. Provide support and personal guidance to the supervisee
    iv. Knowledge of the institutional support structures, when there is a need to refer the supervisee to other personnel (e.g. for psycho-social support or mental health issues).
    v. Acting as exemplars.
    vi. The skills necessary to communicate effectively with supervisees from different cultures

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vii. Be able to balance between supporting supervisees and allowing them to grow as independent researchers.
viii. Taking the time to explain decisions to the supervisee to engage the supervisee in the decision process

Explanation: Guideline 2.6 reflects the discussions in workshop round 1. Guideline 6a, 6e and 6e.1 are based on the results of workshop round 1. 6c was moved from guideline 1.3. guideline 6b was added based on the SoRs. Guideline 6d was added based on the focus groups – after workshop round 2. Guideline 6e.i-6evii were based on the SoRs. Iv was altered to include mental health issues. Vii was added based on the discussions in workshop round 2.

7. **Responsible and skillful supervision should be at the core of supervision tasks**
    a. Provide training to all research who supervise and to all those who wish to supervise in the future to become skilled at supervision
    b. Ensure that supervisors are sufficiently qualified in the specific research field of their supervisee
    c. In some circumstances, consider allowing researchers who do not wish to supervise to progress in their academic career without the need to supervise (room for everyone's talent).

Explanation: Guideline 2.7 was made based on the reflections in workshop round 1. The changes made to the guideline and the subpoints reflect three points made in workshop round 2: 1) the need to specify what suitable is, 2) that institutions should not assume that everyone is already a suitable supervisor, and everyone needs training and support and 3) Make sure parts of supervision program are obligatory to ensure people who wouldn't otherwise come, show up, and improve supervision skills of those who need it the most. These changes were made to subpoint a and c, point b was not changed.(previously 'Ensure that only suitable people take on the role of supervisor').

8. **Require supervisors and PhD students to sign agreements regarding supervision about:**
    a. See guideline 1.7 for further details
    b. Tailor the supervision agreements to the personal needs of the supervisee

Explanation: The subpoints under this item were removed to reduce duplication in the guidelines.

9. **Reward and recognize good supervision**
    a. Reward supervision through recognition and awards
    b. Reward good supervision with tangible rewards, such as funding, financial rewards and career advancement

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c. Give supervision more acknowledgement as an important task in the research process

Explanation: Guideline 2.9 is the result of workshop round 1, mentioned as an important topic by both groups. For guideline 9a, what soft measures mean is a gap. Guideline 9b and 9c are the result from workshop round 2. Guideline d is based on the insights from workshop round 1.

10. **Facilitate peer-to-peer support for supervisors**
    a. Create and stimulate peer to peer support groups for supervisors
    b. Possible options for peer to peer support include the organization of:
        a. Interdisciplinary supervisor workshops
        b. Meetings between supervisors to exchange experiences
        c. The exchange of knowledge and experience through co-supervision

Explanation: Guideline 2.10 is the result from workshop round 2, where participants noted PhD-to-PhD peer support was present, but was absent for supervisors. The subpoints were also added based on the insights from both groups from workshop round 2.

11. **Evaluation structures for supervision**
    a. Address supervision problems in evaluation meetings
    b. Create a structure of regular constructive feedback between supervisor and supervisee, and superiors of supervisor

Explanation: Guideline 2.11 is the result from workshop round 2, where evaluation structures was analyzed to be a separate point from rewarding and recognizing good supervision.

Best practice examples:

- When providing training for supervisors, provide separate training for starting and experienced supervisors
- Reward and stimulate good supervision by attributing a supervisor-of-the-year award

Building and leading an effective team

Title of skeleton guidelines:

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Guideline for building and leading an effective team in research institutions

Guidelines:

Note: We use the term 'leaders' for senior researchers who lead a team of researchers. These may include principal investigators (i.e., PIs), department heads, section leaders, etc.

1. **Organizational structures related to leadership need to be in place**
    a. Improve support services for research leaders concerning
        i. Finances
        ii. Grant writing and publications
        iii. Transparent management
        iv. Easing the administrative burden of research leaders
    b. Improve protection of research leadership against issues of
        i. Research misconduct
        ii. Leadership failure
    c. When leadership issues arise in the institution, transparently report the concerns to ensure that they are dealt with

Explanation: Guideline 3.1 is the result of workshop round 1. Point 1.iii and iv were added based on insights from the second workshop

2. **Facilitate training for leaders**
    a. The content of the training should include
        i. Improving knowledge and communication on research integrity
        ii. Improving interpersonal and leadership skills, such as management skills, listening skills, empathic skills (also see item 12)
        iii. Tips on how to be, or become a good and effective leader
    b. Training should become part of the employment package and be mandatory

Explanation: Guideline 3.2 is the result of the exercises from workshop round 1, and was considered important for both groups. Point a.iii was revised based upon a comment from a participant.

3. **Provide research leaders with the time, skills, and resources to build a strong research team**
    a. Ensure that research leaders are able to create a positive environment
    b. Ensure that research leaders have the skills and resources to build their own team with their own knowledge base in which a diversity of profiles (diverse skills and backgrounds) can thrive

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c. Provide sufficient resources to research leaders to create good teams, create support structures and create a good facility

Explanation: Point 3.3 is the result from the exercises from workshop round 1. The text is changed from 'community' to 'research team' to better reflect the discussion on this topic in workshop round 2. Point 3.3.b is altered the reflect the discussions of workshop round 2.

4. **Create 'leaders for leaders groups'**
    a. For research leaders to learn, support, exchange, discuss, engage and share

Explanation: This was separated from point 3.3, the community aspect now is covered in 'leaders for leaders groups'. subpoint 3.3.a was included in point 3 previously.

5. **Create and implement support structures for the well-being, care and mental health of research leaders**
    a. Provide guidance to leaders on balancing their time between their own needs and those of their team members
    b. Provide support services for well-being and mental health of research leaders

Explanation: Guideline 3.5 is the outcome of workshop round 1, but rephrased to aim to answer to the implementation issues (previously: Ensure the well-being of the research leader). Point a is from workshop round 1, point b was refined.

6. **Ensure that only suitable researchers take on leadership roles as researchers**
    a. Train research leaders (see point 3.2) on important skills for research leaders, such as
        i. Share skills with the research team
        ii. Good communication skills - institutions should require research leaders to develop clear policies and procedures on collecting, maintaining and communicating data with the research group/team
        iii. Keeping a positive attitude
        iv. Interpersonal skills and empathy
        v. Good supervisor skills
    b. Ensure that research leaders are sufficiently qualified in their specific research field
    c. In some circumstances, consider allowing researchers who are not suitable research leaders to progress in their career with other academic duties without the need to take on research leader tasks

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Explanation: Point 3.6 was the result of workshop round 1. In the second workshop a 'conflict' was identified between whether an academic career is possible without taking on supervision or research leader tasks. This is an implementation and not easily addressed. For point a. iii – 'Usually also helps personally, for your own well-being; but besides that, this is not something that everyone has by nature, and it will also be difficult to really train', implementation issue addressed in the comments on the guidelines.

7. **Promote incentives for good leadership**
    a. Create the right research environment which sees good leadership as important
    b. Recognize supervision as an important task of a research leader
    c. Allow researchers to set their own goals to realize different ambitions and talents
    d. Assess leadership (e.g., feedback from colleagues)

Explanation: Guideline 3.7 is made based on the insights from workshop round 1. Point d was added based on the insights from workshop round 2.

8. **Introduce good criteria for promotions and assessment**
    a. Criteria for promotions and assessment should include other elements besides publications and grants
    b. Have periodic reviews to assess leadership

Explanation: Guideline 3.8 reflects the discussions from workshop round 1. Point a was refined to better reflect the discussion in round 2.

9. **Ensure a positive environment in which rigorous research can flourish**
    a. To slow down science
    b. Take responsibility to keep up with global developments of science
    c. Desensitize mistake and failure

Explanation: Guideline 3.9 reflects the exercises and discussions from workshop round 1. A big implementation issue arises here: 'Is it really the responsibility of the research leader? Responsibility is more at national level, EU level, funding system, political responsibility for system of science'. Needs to be further refined, as these issues cannot be addressed by only rephrasing the guidelines.

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10. **Ensure academic freedom by providing research leaders, and in extension the research teams, with adequate opportunities and possibilities to determine the direction of the research**
    a. Research leaders should, if no other options are available, have the possibility to change the research plan
    b. Regulations (from funders?) should not prevent the possibility to change the research plan under changing circumstances
    c. Grant writing competition should be addressed to ensure researchers do not try to fit 'their research' in a mold that isn't theirs to fit, and to allow them to have more freedom in setting the research topic

Explanation: Guideline 3.10 was developed based on workshop round 1. Based on the discussed implementation issues in round 2, a more restrictive version of freedom was set up previously the recommendation was ***(Provide the opportunity for research leaders to have freedom to set the directions of research).*** *However, it is still difficult to let research leaders set more freedom of setting the directions of research. Guideline a and b were rewritten to fit the topic, and to restrict the definition of freedom. 10.c was added based on insights from workshop round 2. For topic c, the implementation levels lies at addressing this problem not only on an institutional level, rather it should be done on a national or EU level.*

11. **The responsibilities of research leaders should be stipulated**
    a. Institutions should clearly demarcate the responsibilities of the institutions and of the research leader
    b. Communicate the responsibilities to research leaders – and communicate which responsibilities are the institutions'
    c. A research leader should be a role model of good research practices
    d. Institutions should provide clear guidance to team leaders how to manage their teams as well as setting out clear lines of accountability
    e. Institutions should ensure that team leaders do not have research groups that are too large to be effectively managed
    f. Research leaders should check crude data to ensure understanding
    g. Research leaders should be incentivized to do research themselves
    h. Research leaders should devote attention to individual research and team members
    i. Research leaders should ensure cooperation and communication among team members
    j. Research leaders should ensure team members are performing the tasks which are right for them (*team members are content/happy with their tasks)*

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k. The objective of a researcher should be to contribute to the advancement of science and the knowledge base: a focus should be on quality over quantity to slow down science

Explanation: Guideline 11 is the results from workshop round 1. Recommendation 11.a,f,g,h,j are based on workshop 1. Guideline 11.b and 11k are based on insights from workshop round 2. Recommendations 11d,e,i are from the SoRs.

12. Ensure that research leaders pay adequate and caring attention to their team members

l. Ensure research leaders can devote and spend sufficient time to each research project
m. Incentivize research leaders to empower individual researchers (i.e., team members) to do research and to explore and follow their interests.
n. Incentivize research leaders to consider the interests of the team before their own interests, where appropriate
o. Measures should be in place to prevent the abuse of power and exploitation of dependent relationships, both at the leadership level and the individual level

Explanation: Guideline 3.12 was rewritten based on the comments from workshop round 2 – previously it was 'human nature of research'. 12.d was based the SoRs. 12.e was deleted because of redundancy (already covered in 12.3.b). (Allow leaders to create a team with sufficient knowledge)

4.2.1.3. Research Environment

<u>Community building for a positive research culture</u>

Title of skeleton guidelines:

Guideline for community building for a positive research culture in research institutions

Guidelines:

1. **Ensure that researchers can work in a safe, inclusive and open environment where they feel responsible and accountable, can share concerns about dilemmas and can discuss errors made without fearing the consequences ('blame-free reporting').**
    a. Create opportunities for community building activities
    b. Create fora, open discussions and dialogues for sharing research activities, viewpoints and ideas

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c. Ensure that the institution adequately tracks and assesses this objective to ensure its fulfilment (i.e., consider researchers' honest feedback) — see BP7

Explanation: Participants in the second workshop expressed that having a safe, inclusive, and open environment was crucial and needed to be a starting points for universities. One participant even added a note to mention that this aspect was "difficult to implement, but the most important thing!!" One of the participant insisted that the inclusive environment must also feel safe and inclusive for those involved when performing co-research with members of the public or research participants, but given the specificity of this comment we decided not to include it. Participants worried that this point was difficult to implement because it is difficult to track that an environment is safe and open, and while it may be on paper, reality sometimes differ. In this regard, participants proposed that finding a way to assess how researchers feel about the environment of an institution and making the results public may be a good way to push for better implementation of the guidelines.

2. **Ensure transparent cooperation and responsible leadership**
    a. Ensure leaders positively influence the research environment of their team
    b. Implement an open door policy with researchers leaders
    c. Facilitate regular meetings between leaders, research staff, managers and support staff
    d. Ensure that cooperation occurs between all levels of the institution, including between research support and university management, between research support and research groups, and between leaders and researchers within the research groups

Explanation: In the second workshop, participants mentioned that this main recommendation needed more clarity and required further granularity and concrete examples. The main concern was that the levels of collaboration were not clear. In this regard, we added point d. to exemplify different levels at which such collaboration should happen.

3. **Ensure responsible performance management, assessment and evaluation**
    a. Revise evaluation processes and criteria and ensure implementation by committees
    b. Assess research on aspects such as versatility, quality and actual impact of research
    c. Assess researchers on non-research related tasks, such as supervision, leadership, peer review
    d. Do not assess research on metrics that emphasise quantity or journal-level impact, such as publication counts, H-index, and Journal Impact Factor, and always complement metrics with human input
    e. Appreciate all research outputs, including those that are not published in high impact factor journals

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f. Aim to align definitions of excellence with research quality
g. Broaden perspectives of impact to include different expressions and forms it can take

Explanation: Participants in the second workshop mentioned that the definition of excellence and impact were highly problematic and needed to be addressed, explaining the addition of points e. and f. Nonetheless, participants acknowledged that such universal definitions were often beyond the reach of research institutions, and may need to be addressed at the funders' level or even at the European level. On a second read, we further increased the granularity on the point d. (initially "Do not assess research on standard metrics such as bibliometrics and impact factors"). The reason for the change comes from the reflection that metrics are not problematic in and of themselves, but they become problematic when they are used in isolation, when they focus on quantity rather than quality, or when they explain journal-level activity rather than article-level activity. Yet, since indicators of open access, peer-review, and transparency are increasingly metricised, we deemed important to add this distinction.

4. **Provide training**
    a. Provide research integrity training for all within institutions — See BP5
    b. Apply training on how to effectively recognize and produce transparent and reproducible research (from experimental design through to publication) to help alleviate researchers' stress and improve their mental well-being.
    c. Ensure that training is a continuous process that is adapted to the needs to different stages of the academic career

Explanation: This item was not extensively discussed except on the point that training should be a continuous process and that it should be adapted to the needs of the researchers to be available at all career stages.

5. **Implement an institutional framework for diversity, equality and inclusion**
    a. Consider all aspects of diversity, including, but not limited to gender, race, disability, career profiles, career breaks, caring obligations, and consider their intersectionality
    b. Foster an environment where diversity, equality, and inclusion are part of the culture — See BP2
    c. Implement a policy and action plan for diversity, equality and inclusion
    d. Provide diversity and inclusion training
    e. Embrace cultural intelligence, i.e. that all cultural backgrounds should be considered

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Explanation: In the second workshops, participants made a strong case for the need to consider diversity in a broad manner which also considers intersectional issues (e.g., combination of diversity factors). We added point a. to exemplify this idea, which will be captured further in the specific guideline set on diversity and inclusion. Participants also insisted that diversity should be part of the mindset of the institution, rather than only in the policies, and mentioned that diversity initiatives should be tracked appropriately. Since we will describe this point in greater depth below, we did not add the need for tracking, but will delve in more details in the diversity-specific section. One participant also raised an interesting point about the need to adapt research timelines to allow participatory action research with people with disabilities. While this point is very interesting, we felt that it was slightly too specific to be included in the guidelines.

6. **Implement an institutional framework for good scientific practice which provide support mechanisms, documents and the appropriate infrastructures**
    a. Ensure existing support services are reachable and findable. Examples of support systems are:
        i. RI services
        ii. Library services
        iii. Data management services
        iv. Information services and package for new employees
        v. Diversity and inclusion support
    b. Ensure guidelines and documents are findable and practical. Examples of support documents are:
        i. Capturing and implementing feedback
        ii. Collaborating with industry
        iii. Data management plans
        iv. Open access policy
        v. Promotion processes
        vi. Guidelines on diversity and inclusion, for example inhiring, promotion, and research activities
        vii. Whistleblowing guidance
    c. Invest in digital infrastructures to ensure that all researchers can access and share information (e.g. data management plans, data limitations, etc.) — See BP4
    d. Frequently seek feedback from researchers to capture the support, infrastructures, and documents that are needed

Explanation: Participants in the second workshop mentioned that this point should be more specific, yet this may be due to the exercise which only included the main guidance, but none of the subpoints (i.e., points a. to e. were presented to participants in advance, but absent during the discussion).

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While this point was otherwise not addressed so deeply, it was addressed in other points by mentioning the need for adequate infrastructures and support that respond to researchers' needs.

7. **Provide guidance and incentives for good mentorship**
    a. Ensure guidance and incentives for good mentorship
    b. Foster an inclusive research environment and best practices by setting an example of good mentorship culture
    c. Implement training and other institutional tools to promote good mentorship
    d. Provide support on mentorship for groups with language challenges (i.e. foreign students, etc.)
    e. Reward good mentorship
    f. Support mentors to work with students

Explanation: This point was briefly addressed in the second workshop where it was mentioned that good mentorship was difficult to define, and that mentors should receive training on good mentorship (a point already covered in h.). A new point from the second workshop was the need for support in groups where language and communication was difficult, now added in point i.

8. **Appoint support persons to foster and support research integrity, including:**
    a. Provide different levels of support
        i. research integrity officers,
        ii. library services,
        iii. support ways how to implement diversity and inclusion measures
        iv. research integrity champions at the researcher level (see item 9)
        v. RI information services
        vi. Ombudsmen and resource persons for students (e.g., RI, mental health support)
    b. Ensure that all levels of support are visible and easily accessible
        i. Provide a safe place for raising concerns in which power differences are minimized and in which a clear whistleblowing policy is ensured — See BP1

Explanation: Participants in the second workshop agreed with this item, but added that power differences needed to be considered carefully to ensure that power differences do not hamper safe whistleblowing, and to ensure that research integrity support was provided and easily accessible on multiple levels.

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9. **Appoint an RI champion per faculty or department to support the research environment.**
    a. Ensure that research integrity champions (i.e., trained researchers who are able to advise on best practice) are available at a faculty or department level, not only at a management level
    b. Provide a channel of local confidential advisors (i.e., researchers who can be consulted in confidence when integrity issues arise) to help raise doubts and questions as soon as they arise (i.e., early contact)
    c. Ensure that everyone feels confident approaching advisors, for example by designating champions from different seniority levels — See BP3

Explanation: There was a full support for research integrity champions in the second workshops, and the topic was discussed recurrently throughout the session. In his regard, we added a few details on the champions according to what participants mentioned was important. One of these points was the need for confidential advisors as individuals with whom questions and doubts could be raised without too much formality. These early support points were said to help discuss issues before they escalate into unsolvable problems. The need to have integrity champions at different levels of seniority was also mentioned as essential to ensure that those in more junior position feel confident and at ease in approaching champions.

10. **Pay sufficient attention to the psychological health and well-being of research group members and the people who lead them.**
    a. Ensure a climate that is conducive to a healthy work-life balance (i.e., minimize productivity pressures, short-term contracts, competition, and acknowledge their impact on mental health and wellbeing)
    b. Provide team leaders the tools necessary to assess the health of the researchers working in a group.
    c. Increase awareness of mental health issues among researchers to help them detect early signs of burn-out and other issues (i.e., consider including as part of the introduction training)
    d. Establish mental health professional channels accessible to everyone (dedicated resources and funding)
    e. Assign and provide training to mental health and wellbeing champions as first responders
    f. Set standards for avoiding the mistreatment of people.
    g. Ensure prevention and when necessary, appropriate response to harassment in the field, lab, office and at conferences
    h. Provide confidential and independent channels for support in case of bullying and interpersonal conflict (i.e., outside of the department)

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Explanation: In the second workshop, participants spontaneously addressed the need to look at mental health. Participants linked mental health issues with the pressures of high demands in research careers and the unhealthy research climates, but acknowledged that these issues may be difficult to change. We decided to include these issues as a first point here since they need increased consideration. Participants also proposed that it was important to train researchers so that they can recognize early signs of burn out or other problems, and that it was necessary to have trained 'champions' also in this setting to act as first responders. Finally, the issue of bullying was mentioned as something that may need to be dealt with external channels to ensure complete confidentiality.

Best practice examples:

BP1: In Flanders, a research integrity commission external to institutions is available to provide second, disinterested opinions on integrity cases http://vcwi.be

BP2: Some universities assign 'diversity officers' who ensure that diversity issues are considered in all aspects of university tasks

BP3: In Flanders, specific 'ombudspersons' serve to help PhD students deal with problems, including with interpersonal issues with their supervisors and integrity issues

BP4: Some universities set mandatory requirements for data management plan at the PhD students level. The university provides the appropriate digital infrastructure. This ensures that students understand the data and its limitations, understand if special approvals are needed, know how to handle the data, etc.

BP5: To encourage training, universities can provide ebadge/accreditation for internal ethics training (Epigeum)

Managing competition and publication pressure

Title of skeleton guidelines:

Guidelines for managing competition and publication pressure in research institutions

Guidelines:

Related to the research environment

Ensure that researchers have the freedom of investigating their own research ideas.

a. **Allow more creativity in setting up and performing research**
b. Allow for more time to work on publications truly reflecting the interests of the researcher
c. Incentivize researchers to only write grant proposals for calls fitting their research

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d. Avoid to source funding on calls with criterion that are overly specific and risk to hinder researcher's freedom and possibility to change gear
e. Ensure the research setting reflects societal needs, and recognizes future problems which require sustainable solutions through scientific research
f. Increase academic freedom to also research areas which are not always considered a prioritized area of research
g. Collaborate with and involve external stakeholders such as policy makers, funders, etc. to promote research freedom more broadly

Explanation: Several participants in the second workshop mentioned the crucial role that funders also have in setting research agendas, and thus believed that funders, but also other stakeholders such as policy makers must be involved to ensure freedom of research. Some points around specific funding channels where projects are too descriptive were criticized, while the need to still keep the priorities of society at heart were also mentioned.

1. **Foster a culture of coordination and collaboration**
    a. Foster collaboration
        i. Incentivize internal collaboration to avoid researchers apply for the same grants
        ii. Incentivize internal collaboration to apply for joint collaborative projects
        iii. As an institution, foster collaboration with external stakeholders such as policy makers and funders (see 3. below)
    b. Provide young researchers incentives and opportunities to be involved in institution management
    c. Remove barriers between fields
    d. Reward, promote and incentivize interdisciplinary research
        i. Allow the possibility to publish interdisciplinary work in journals of the specific disciplines for community endorsement and engagement
        ii. Incentivize collaboration between various institutions to prepare joint publications to reduce publication pressure of early career researcher
        iii. Maintain integrity and best practices between fields

Explanation: Participants to the second workshop agreed with the need to foster a culture of collaboration, and they emphasised that this culture must involve stakeholders outside of the institution. The example of a 'quadruple helix model' in which policy makers, RPOs, RFOs, citizen, and non-academic sectors must collaborate with one another was mentioned, leading to the addition of the subpoint 2.iii. here and the point 3. below. Later in the workshop, the idea that "Junior researchers don't always have opportunity or incentive to be involved in management" was mentioned and we believed that it would add to this multi-level collaboration and coordination topic.

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2. **Involve external stakeholders such as policy makers, funders, and society**
    a. Facilitate an open conversation between stakeholders

Explanation: As detailed above, the need for institutions to involve different external stakeholders was a recurrent topic, most often mentioned as one of the reason the guidance risk being difficult to implement.

3. **Shared responsibility between the institution and individuals for funding and contracts**
    a. Share the responsibility of securing funding with the researchers
    b. Favour more permanent career structures in which researchers' salary are secured rather than temporary self-funded contracts
    c. Foster an environment in which researchers can keep the bigger picture of their work without needing to focus on securing funding

Explanation: This point was raised in the second workshop and proposed an interesting idea to reduce the pressure on researchers to seek funding (which can lead them to compromise research freedom, to experience stress and psychological health issues, and several other potentially damaging issues and behaviours. In response, participants thought that institutions should share the responsibility of funding with researchers, at least to ensure that researchers' salaries are secures and that contracts are as stable as possible.

Related to rewarding and valuing researchers

4. **Provide rewards and incentives for research, non-research, and non-publication related activities**
    a. Reward and evaluate non-publication activity such as
        i. Teaching
        ii. Peer review
        iii. Editorship
        iv. Supervision
        v. Dissemination
        vi. Outreach
        vii. Societal impact

Explanation: This item was discussed in the second workshop, not so much for its content, but for its wording. Participants explained that it was not clear what non-research activities were, so the expression non-publication activities was added to provide further distinction.

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5. **Adopt responsible evaluation practices**
    a. Base researcher evaluations on inputs form different levels of colleagues by including individuals in supervisor and supervisee positions (i.e., 360° evaluation)
    b. In evaluations and promotions ask for a selected list of publications and ask the researcher to reflect on their work to move from quantity to quality.
    c. Consider diverse forms of impact
    d. Set and clarify the diversity of criteria used in evaluation, including mandatory criteria for all those receiving evaluation and role-specific evaluation criteria
    e. Make efforts to implement the recommendations from the Declaration on Research Assessments (DORA), the Hong Kong Principles, the Leiden Manifesto, and other guidance on good research assessment
    f. Aim for a standard of evaluation practices across universities, countries, disciplines
    g. Coordinate assessments with an "equality impact assessment" to ensure that they do not deepen inequalities
        i. Ensure that evaluations do not disadvantage researchers who had parental leave (e.g., do not rely on cumulative number of publications)
    h. Avoid monetary incentives.

Explanation: Participants from the second workshop recurrently mentioned this item during the workshop. Aspects b. and d. were added to capture the recurrent perspective that assessments need to have a broad perspective of candidates and their achievement, both by involving a diversity or evaluators and input and by challenging traditional perspectives of impact in research. Point g. tackles an aspect that was mentioned several times as a possible barrier to implementation. In fact, participants explained that, to impact cultures, evaluation practices needed to become standards across institutions and, if possible, also across countries. And finally, responsible evaluation practices were also associated with diversity issues. Participants explained that the impact of assessments on equality and diversity should be considered, and that career breaks and leave which can result in lower cumulative outputs should not disadvantage applicants. On this last point, participants reiterated the point c. according to which evaluating should be based on an in-depth selection of applicants outputs rather than on a full profile. Finally, in addition to participants feedback, we also decided to modified point f. (initially "Endorse and implement DORA, the Hong Kong Principles, the Leiden Manifesto") to ensure that institutions focus on implementing the recommendations of those documents before signing their name on them (i.e., they should ensure that they have the infrastructure and resources needed to follow these guidance before endorsing them). Since different assessment guidance might not be completely compatible with one another, we also deemed that, when facing conflicting recommendations, institutions should be allowed to select recommendations that fit best their setting. Finally, for coherence, we moved the last point (i.) here from the first point of this set.

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6. **Create and implement a research career roadmap**
    a. Ensure stability and opportunities of career paths
    b. Create shared responsibility between the institution and those with short-term contracts/early career researchers to strengthen the position of the early career researchers to remain within the institution
    c. Formally inform students about alternative career paths (e.g. dedicated lectures)
    d. Allocate part of funding to junior researchers when senior researchers receive grants
    e. Older investigators should be encouraged to move into alternative stages of their career — working in teaching, mentoring and science advocacy — that don't require research funds. This could help a shift of resources to the younger people.
    f. Consider diversifying career options also within academia with intermediate options (i.e., between post-doc and professor positions)
    g. Develop a research career roadmap which includes:
        i. Long term prospects for within academia
        ii. Possibility to develop the relevant skills and requirements to transition to industry

Explanation: Academic careers were briefly discussed by participants in the second workshop, mostly in relation to the lack of careers in academia and the general closeness of academia towards external career options. Participants mentioned that students should be better informed about careers outside academia, a point we will revisit in the section on 'Adequate education and skills training'. Nonetheless, participant pointed out that the fact that most of those who are in academia have never worked outside academia created a roadblock both in acceptability and in awareness of external career options. Finally, one respondent proposed that careers within academia should also be diversifies to allow more permanence in careers that are not necessarily at the level of responsibility of a PI. This last point relates back to the item 4. above in which participants discussed the need for institutions to alleviate the burden experienced by early career researchers who constantly need to look for funding.

Related to publications and workload

7. **Ensure that published research is open and transparent**
    a. Provide training on good publication practices
    b. Create opportunities to involve students in editorial and peer-review practices — see BP7
    c. Prevent bad publication practices by:
        i. Not asking for long publication lists

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ii. Setting reasonable expectations that take into account different stages of career
iii. Focusing on the overall output of the researcher, rather than only their publication

d. Promote good publication practices by:
   i. Recognizing the quality, not only the quantity of publications
   ii. Encouraging and recognizing preregistrations and preprints
   iii. Encouraging and recognizing publication of negative/null results
   iv. Encouraging and recognizing open access publications (and invest the resources to allow researchers to afford reasonable APCs) — See BP8

Explanation: Publications were briefly described in the second workshop. The first point that was mentioned was that the initial recommendation, which asked that publications be 'qualified' was unclear. Instead, participants described practices which largely relate to openness and transparency. Among other things, participants mentioned the need for preregistrations, preprints, publication of negative results, and open publications. On this last point, although it was not mentioned directly by participants in this item, we added that institutions should also help participants secure the means for open access publications before valuing them. Finally, one participant provided an example in which young researchers were introduced to editorial practices and peer-review, and argued that such experiences help young researchers understand the publication process and should be valued by institutions, for example by encouraging student journals.

8. **Ensure a balance in researchers' workload**
   a. Ensure researchers have dedicated research time
   b. Ensure researchers have equal opportunities to publish
   c. Ensure researchers can balance teaching and research activities
   d. Implement strategic selection of funding calls within institutions. Send one strong funding call to decrease competition in a certain field
   e. Ensure that expectations allow for parental leave, diversity, and reasonable expectations at different career stages
   f. Ensure well-being of researchers
      i. Implement surveys to investigate the well-being of staff members and act upon the findings to improve perceived pressure and stress

Explanation: The issues related to researchers' unhealthy workloads were mentioned on a few instances in the second workshop, but the specific aspects were scarcely discussed. One aspect that

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was slightly new was the idea that parental leaves may be perceived as an hindrance on researchers' career, and the need to prevent this problem (point i.).

Best practice examples:
BP6: Publish institutional staff survey results including the negative comments
BP7: Create opportunities to involve student in peer- review and journal editorials (e.g., student run journal)
BP8: Support researchers in their activism (e.g., decision to avoid to peer-review for profit-motivated journals)
BP9: In Wallonia there is a funding programme for PhD students and postdocs to start spinoffs

Adequate education and skills training

Title of skeleton guidelines:

Guidelines for providing adequate education and skills training in research institutions

Guidelines:

1. **Foster cooperation, communication and discussion among researchers to ensure that they can learn from each other's skills**
    a. Ensure established researchers have a background in collaboration and openness
        i. Foster cooperation with management, researchers and support staff
    b. Have an open door policy and open communication practices
        i. Create fora for discussions and plan internal meetings
    c. Ensure good peer review practices at all levels of research
    d. Encourage work-in-progress seminars, also at the interdisciplinary level
    e. Provide researchers and students the space and the resources needed to enable them to organize bottom up initiatives for support, training, and informal discussion
    f. Encourage researchers to organize events where they can discuss non-project-specific affairs (e.g., integrity, policy, etc.)
    g. If possible, include junior researchers in Research Integrity Committees — See BP12

Explanation: This topic captured particular interest in the second workshop. Participants discussed the importance of more informal meetings and discussion among researchers, and mentioned that many researchers are willing to take initiatives to organise these events themselves, so institutions should encourage them and provide infrastructures and facilitators. Another point that was mentioned was the possibility of involving junior researchers in research integrity committee discussions. This point,

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however, raised a debate between participants since some argued that confidential information should not be be entrusted to young researchers while others maintained that trusting young researchers' confidence was part of the contribution.

2. **Create support offices**
    a. Have support offices to support open science and best practices, such as data curation, data sharing, reproducibility, correct statistical analyses, etc.
    b. Reward and recognize the cooperation with support staff
    c. Ensure that support offices also encourage bottom up initiatives from researchers
    d. Ensure that support offices focus on supporting researchers, not the institution
    e. Provide research support infrastructure such as software, access to statisticians

Explanation: Support offices were mentioned several times in the second workshop as the facilitators for several other initiatives. The point was also made that support office should sometimes be reminded to focus on supporting researchers, not institutions.

3. **Develop a relationship with other sectors to ensure researchers have transferable skills for future employment**
    a. Transferable skills include
        i. Organization management
        ii. Negotiation skills
        iii. Communication skills
    b. Strengthen the partnership with other sectors (e.g., industry but also policy makers and public sector) to provide students an opportunity to experience and build skills for careers outside academia — See BP13
    c. Encourage co-financing of research from industry partners to open opportunities for investment and employment — See BP14
        i. Clarify to researchers and research leaders under which circumstances new industry collaborations are allowed (e.g. collaboration with the tobacco industry is prohibited)
        ii. Ensure transparency on industrial collaborations preferences and contributions (e.g., mention both institutions on publication to strengthen the visibility of both)
    d. Tackle negative attitudes towards those leaving academia

Explanation: The need to develop a relationship with other sectors was a topic of great interest in the second workshop. Participants were highly positive about students' experience in industry, and there

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was a general agreement that internship placements should be encouraged and that collaboration with other sectors should be actively sought. Importantly however, other sectors was widened to include also policy sector and public sector as opposed to the typical industry sector which was covered in earlier versions of the guidance.

4. **Provide opportunities to conduct research at other institutions and/or abroad**
    a. Encourage mobility schemes (e.g., Erasmus) also at the faculty level — See BP10

Explanation: As part of the placement ideas, the importance of obtaining experience in different settings was also discussed in the second workshop, and participants mentioned that such experiences should also be encouraged for more senior members of the institution.

5. **Provide adequate guidance about good research practices, in which the responsibility of research leaders and institutions is also clarified (e.g. related to grants, conflict management, research practices, etc.)**
    a. Ensure visibility, awareness, and use of relevant European guidance
    b. When possible, coordinate requirements for good research practice across institutions — See BP11

Explanation: On this item, participants in the second workshop highlighted that numerous excellent guidance already exist, and that instead of reinventing the wheel, institutions should promote their visibility. Also, the importance of standardizing good research practice expectations and training was described as something important.

6. **Provide sufficient training to researchers on various skills required for their work, such as technical skills, analytical skills, and research methods:**
    a. Dedicate a budget for training, training infrastructures, and training staff
    b. Provide training and opportunities for skills building to all levels of seniority
    c. Create a large course at the beginning of academic career, and smaller, tailored courses throughout career
    d. Embed history and status of science in educational programs to teach general understanding of science
    e. Involve researchers in the training curriculum to ensure that training offered corresponds to their needs
    f. Education and regular updates on research methods
    g. Leadership skills to principal investigators

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Explanation: On the training for hard skills development, the need to provide training at all levels of seniority and to ensure that the needs of researchers are covered in the training offered in the institution was mentioned by several participants of the second workshop. The fact that a dedicated budget for training is necessary to provide quality training was also a small aspect in the discussion.

7. **Ensure strong mentorship during degree phases to teach young researchers the right research methods**

Explanation: This point was not addressed in great depth in the second workshop.

8. **Provide sufficient support for data management practices**
    a. Ensure there are sufficient data support structures, including human resources (e.g. data stewards, data offices) and those are accessible
    b. Establish a clear collaboration between research offices, libraries, and research management to ensure that the services provided are aligned
    c. Ensure visibility, awareness, and use of relevant European guidance
    d. Have control and understanding about data: storage, meta-data, data management, etc.
    e. Create good and easy to use data repositories — See BP4
    f. Have clear structures for data management plans
        i. Establish data management plans that apply to all researchers, as well as data management plans specific to each department
    g. Research leaders should support group members in adequate data management
    h. Ensure researchers transferring data between institutions do this properly

Explanation: On the point of data management practices, participants to the second workshop stressed the importance of ensuring a strong collaboration between the different services of the university.

9. **Implement strategies to also train and support researchers' transferable skills**
    a. Provide training that target a broad range of skills such as
        i. organizational skills,
        ii. project management,
        iii. conflict management,
        iv. reproducibility expertise,
        v. emotional intelligence training and development,

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vi. curiosity, empathy, listening skills,
vii. etc.

b. Allocate dedicated time for soft skill development at all seniority level — See BP17

Explanation: The need for soft skills development also raised some interest among participants of the second workshop. Participants explained that often it is difficult to find the time to develop soft skills in later seniority levels and proposed that institutions allow more senior researchers to dedicate time to it.

10. **Implement monitoring and feedback structures focusing on researchers' skills**
    a. Allow possibility for giving constructive feedback as a team to each other, and specifically to supervisors and research leaders
    b. Provide researchers the opportunity to set their own objectives upon which they should be assessed
    c. Implement monitoring and feedback at all level, not only on junior researchers
    d. Implement monitoring and feedback on open access compliance
    e. Those in charge of the monitoring should be qualified to do so.

Explanation: In the second workshop, the use of the term audit was raised as being problematic. Participants explained that audits had a negative connotation of policing which could reduce the willingness of researchers to collaborate. Instead, terms such as 'sensitivity check' and 'spot check' were proposed. For clarity, we settled for the term 'monitoring' in the guidance.

Best practice examples:

BP10: Erasmus scheme can help support staff to exchange ideas

BP11: In Denmark, Responsible Conduct of Research courses are coordinated across institutions to ensure a common agreement on what is good scientific practice

BP12: In institutions where RI committees have different phases, students and junior researchers could be involved in organization phases where no confidential information is discussed

BP13: Marie Curie secondments are meant to promote placements in non-academic institutions (but not always realized)

BP14: In Wallonia there is a funding programme for PhDs and postdocs to start spinoffs

BP15: Encourage exchanges where Masters and PhD students perform research in the industry for part of their degree (initiative that is frequently in place in the UK)

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BP16: European Commission co-fund, where national funding bodies get co-funding from the European Commission for PhD or Postdoc programs, upon the condition that they include some kind of secondments in the programs.

BP17: Transferrable skills training for all researchers can be fostered easily in online webinars, incorporated as part of Structured PhD programmes etc.

Diversity and inclusion

Title of skeleton guidelines:

Guidelines for diversity and inclusion in research institutions

Guidelines:

1. **Understand diversity in its broad meaning, without limiting to specific diversity issues**
    a. Consider all aspects of diversity, including gender, ethnicity, sexual orientation and disability, but also different factors that may impact outputs and researchers' achievements, such as care or family issues, or simply different backgrounds and sectors that must be taken into account in certain research decision
    b. Embrace an intersectional approach to diversity issues to consider cumulative impacts
    c. Ensure that invisible populations, such as those with learning disability, are adequately considered
    d. Avoid comparing profiles without considering underlying conditions (e.g., medical issues, care issues, family issues, career change, etc.)

*Explanation: This point is entirely new from discussions in the second workshop. Indeed, participants were very interested in diversity issues, but maintained that the current views of diversity were often limited to gender issues, rarely even discussing race and disability. Participants argued that, instead, diversity should consider all minority groups, and that the intersectionality of diversity issues (e.g., black **and** woman) were also very important to consider appropriately.*

2. **Implement a structure of data collection and metrics for diversity and inclusion**
    a. At the center of any diversity and inclusion guideline or policy should be data collection and metrics on diversity and inclusion to evaluate the status of the institution which will aid in improving the D&I policy
    b. Transparently and publicly report the progress on diversity initiatives and diversity metrics (e.g., on the university website)
    c. All aspects of diversity should be included in the data collection: including gender, ethnicity, disabilities, socio-economic background, etc.

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Explanation: Participants to the second workshop did not extensively discuss the need for a metric for diversity, but they supported that diversity reports from research institutions should be made public, mentioning both the advances and the issues that are still lacking behind. More specifically, participants maintained that a form of inter-university competition to do well on diversity issues could be helpful. The bronze, silver, and gold medals of the Athena Swan program were mentioned many times as a good practice example, as we will discuss further in point 4.

3. **Adopt institutional policies on diversity and inclusion**
    a. Create action plans on diversity and inclusion with clear deliverables, timeline, resources and responsibilities
    b. Go beyond the minimum directives and EU jurisdiction
    c. Implement a holistic institutional framework on increasing diversity and inclusion where various issues are addressed including recruitment, promotions, mentorship, research performance assessment, training, etc.
    d. Adopt and uphold strict consequences for derogatory and discriminatory behaviours
    e. Monitor diversity policies to ensure that they are adapted to the context and remain helpful without generating further discrimination
    f. Include policies for diversity in conference and seminar organization and attendance policies
    g. Ensure fair pay

Explanation: In terms of policies, participants to the second workshop emphasised the need to go beyond the legal minimum of diversity policies. The need for genuine consequences (i.e., a no tolerance policy) on derogatory comments was mentioned a few times, while the issue of fair pay was mentioned but scarcely expanded upon.

4. **Have high level institutional awareness and commitment**
    a. Institutions should commit and prioritize diversity at the highest level
    b. Create a holistic diversity policy to not just consists of different components but to connect all aspects
    c. Create a diversity policy within institutions from the highest levels to ensure complete embedment within the entire institution
    d. Make efforts to keep open mindedness and openness to change expectations at high level institutional structures
    e. Clearly communicate the diversity and inclusion policy

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f. Include cultural awareness, tolerance and openness, acceptance of different ideas and viewpoints, raising awareness and celebrating diversity policies and practices that promote diversity and inclusive environment
g. Sign up to the principles of the Athena SWAN Charter and adopt other employment practices that support diversity and inclusion — See BP19

Explanation: The discussion did not discuss institutional awareness and commitment in depth, but the need for institutions to keep an open mind for change was mentioned.

5. **Build a supportive community for diversity and inclusion**
    a. Create a supportive and safe space for people to express their thoughts and feelings, speak of the racism they experience inside science as well as outside.
    b. Foster a shared understanding and dialogue which considers also perspectives of the majority to adapt policies and support adequately and increase acceptation
    c. Build a 'landscape of care' at all levels: interpersonal, organisational, structural (i.e., micro, meso, macro)
    d. Openly discuss diversity issues whenever possible to increase awareness and to embed the discourse in the landscape or everyday practices — See BP18
    e. Consider the impact of research expectations on diversity issues (e.g., short term contracts and assessments based on outputs can strengthen discrimination)
    f. Involve researchers bottom up to increase community engagement and to make diversity and inclusion an institutional priority
    g. Involve dedicated associations to foster a sense of community at all levels in the institution
    h. Accept that researchers may not speak at conferences where gender issues are ignored, or participate in panels where diversity is not considered.

Explanation: The role of the supportive community in diversity and inclusion was one of the most mentioned item on this topic in the second workshop. In fact, participants the importance of discussing diversity in all research activities was mentioned as a way to embed it in the culture of the institution. The need for a landscape of care in which all levels of the institution are involved was also mentioned. Interestingly, the voice of the majority was also said to be essential to building a supportive community, not only to understand the issues and reservations individuals can have towards diversity initiatives, but also to involve the majority in the diversity discourse and ensure that they take part in it rather than feel it impose on them. Furthermore, a recommendation to involve dedicated association in the institution and also in research was said to be a way to increase support and involvement of minority groups. Finally, participants to the second workshop raised an interesting point related to researchers' activism, stating that researchers can also take a strong

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stance by refusing to partake in activities and groups where diversity issues are not respected, and that this choice should be embraced by the institution..

6. **Adopt models, examples and representations**
    a. Have role models and success stories of individuals or teams to set an example for others
    b. Establish diverse top-management teams
    c. Have open discussions about research at all levels
    d. Consider renaming important structures (e.g., buildings, aulas, etc.) to reflect diversity

Explanation: This item was not really targeted in the second workshop except in one small and relevant recommendation to consider diversity when naming buildings, which we expanded to any university structures.

7. **Create support systems**
    a. Have safe and transparent mechanisms in place for reporting diversity and inclusion issues
    b. Have procedures for whistleblowers in place
    c. Have support structures in place to allow mediation and discussion

Explanation: We did not add any specific point to this item based on the second workshop.

8. **Ensure a safe environment for all**
    a. Ensure that researchers can work in a safe, inclusive and open environment where they feel responsible and accountable, can share concerns about diversity and inclusion issues, racism, sexual harassment and discrimination.
    b. Adopt and uphold strict consequences for derogatory and discriminatory behaviours
    c. Involve affected collectives to determine what a safe environment means to them

Explanation: One participant to the second workshop added a post-it note stating "!!!! Super important!!!!" next to this point, and indeed other participants mentioned that this was essential, and should be a starting point. Participants, however, mentioned that the concept of a 'safe environment' may differ between people, and that minority groups should be involved in the discussion to determine what is a safe environment for them.

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9. **Provide diversity and inclusion training program and practices, such as:**
    a. Have diversity and inclusion as a part of standard training (i.e., integrate diversity training in the regular curriculum)
    b. Consider implementing unconscious bias exercise and training for all
    c. Do not limit diversity and inclusion training to young researchers, but involve all researchers and research staff, including those who lack interest to participate
    d. Provide diversity and inclusion workshops
    e. Build diversity and inclusion into research induction
    f. Offer courses related to diversity and inclusion, such as:
        i. unconscious bias
        ii. sex/gender dimension in research
        iii. intersectionality issues

Explanation: Diversity training was discussed in the second workshop, but participants maintained that diversity issues should not be taught in separate courses, but rather be included throughout regular training and regular courses. This would also ensure that diversity training is not limited to those interested on the topic, but reaches everyone in the institution. For this reason, we removed the former point which maintained that RPOs should 'Have separate diversity and inclusion training'.

10. **Reward diversity and inclusion by giving 'gold medal' for the diversity status of the institution — See BP19**
    a. Increase public information on diversity efforts, but also transparently reflect limits of diversity within the institution
    b. Reward diversity efforts in research institutions and research activities, and impose consequences for failing to embrace inclusion (e.g., tie funding to diversity)
    c. Ensure that rewards and assessments for diversity do not result in discrimination of the majority

Explanation: Participants to the second workshop proposed that there should be rewards for upholding diversity efforts, but there should also be consequences for failing to do so (i.e., the carrots and the sticks). For instance, increasing the visibility of diversity issues and failed objectives were mentioned, and the possibility of tying funding to diversity was also raised.

11. **Implement recruitment sensitive to diversity and inclusion**
    a. Create a shared and transparent plan of recruitment procedures
    b. Remove physical barriers for people with mental or physical disabilities
    c. Ensure that diversity issues are not only considered in the selection of candidates, but also in the composition of selection panels

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i. Introduce specific training on unconscious bias, focusing on managers who are part of interview board

d. Ensure that applications and job advertisement promote diversity
   i. Ensure that job advertisement are transparent, visible, and open to all — See BP20
   ii. Consider the wording of job advertisement to ensure that it does not attract only majority profiles (e.g., use collaborative terminology, not only leadership terminology)
   iii. Ensure that application channels are inclusive and accept applications in many forms (e.g., not only by email or online applications, but also by post)
e. Always take the context from which applicants come from into account (i.e., past opportunities, seniority, caring duties, etc.) to fairly assess profiles
f. Consider introducing anonymous application processes
g. Consider positive discrimination when it is justified to reduce existing gaps (e.g., quotas)

Explanation: Diversity and inclusion in recruitment was one of the most addressed topics of the second workshop, and visibly one that participants cared a lot about. For instance, participants explained that beyond including diversity measures in hiring decisions, the hiring panels should also be inclusive and diverse. In addition, the format of job applications was mentioned several time, with participants insisting that the wording of applications should be attentive to attract diverse profiles, that the places where the positions are advertised should be highly visible to all, and that the channels through which applications can be received should not depend on an internet connexion. One participant mentioned that applications could be anonymous, but this recommendation was not exemplified further (point e.). One participant also proposed that we should not be afraid of imposing strong quotas, but there were also reservations from certain participants about positive discrimination which, although useful, was said not to be accepted in all countries. For this reason, we phrased these two recommendations loosely by proposing that universities 'consider' these recommendations.

12. **Ensure diversity in research samples**
    h. Encourage consideration of diversity in selection of research topics and research priorities
    i. Encourage adequate gender diversity to build representative samples in animal research to maximize generalizability of results, but avoid imposing research sample specifics (i.e., avoid over-regulating),

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j. Increase awareness for the benefits of inclusivity in research designs (e.g., diverse research culture enhances research results, diverse and representative research samples contribute to generalizability, etc.)

Explanation: Participants in the second workshop also added several elements of details to the need of including diversity in research samples. First, they mentioned that this could apply both to research topics, or to the selection of animals in animal studies. In the latter case, participants explained the problems that the all-male-medical-research have caused on generalizability of the data, and they discussed the need to ensure that the samples are representative. Some proposed that funders and institutions could mandate balanced samples, but other participants felt uneasy about letting funders and institutions take decisions about how the research is conducted in the lab. Consequently, we carefully phrased the recommendation i. by adding "but avoid imposing research sample specifics".

Best practice examples:

BP18: When political events in which diversity issues are discussed, events and discussion can be organised in the institution as a platform to increase awareness

BP19: Join international reward schemes such as Athena Swan

BP20: Best practice: (inter)national public website for all academic job advertising (e.g., jobs.ac.uk)

4.2.2. Results from the CCW for the RFO topics

4.2.2.1. Monitoring of funded application

Execution of research grants

Title of skeleton guidelines:

Guidelines on execution of research grants for research funders

Guidelines:

1. **RFOs should have clear guidelines about the monitoring the execution of the research**
    a. Internal guidelines about what to monitor
        i. involvement of all relevant stakeholders in the definition of the guidelines
        ii. clear procedures in place
        iii. monitoring should depend on the lifetime of the project, on the budget and on the capacity and size of the RFO

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   iv. guidelines should be not too long and complicated
- b. Guidelines to the beneficiary
   i. about what is expected and how to comply with the grant agreement
   ii. these guidelines should not be too long or complicated
- c. clear reporting timeline
   i. RFOs should guarantee the possibility to make amendments in case of specific circumstances by providing a clear justification
   ii. Ensure that the deadlines provide enough flexibility/adaptability to avoid pressure that might lead to RI breaches
- d. about what happens if the project does not meet the requirements
   i. any delay has to be justified
   ii. RPOs/PIs have to report timely if something goes wrong
   iii. stop funding and ask money back if no justifications are provided in due time

Explanation: all the recommendations are concerning the what, how and when of the monitoring process.

2. **RFOs should monitor:**
   - a. Timing and compliance with the grant agreement
      i. depending on the capacities of the RFO
   - b. Implementation of the project
   - c. Depending on the research (clinical trials, education programs, trainings, communication, outcomes) but also on relevant approvals (ethics including), and infrastructure necessary to do the research, budgetary capacities etc.
   - d. Publications, diverse deliverables (e.g., databases, websites, educational resources, and other forms of grey literature), participation in conferences, meetings, etc. and all activities related to the project
   - e. The availability of open data
      i. this should include all data
      ii. quality rather than quantity
   - f. Societal impact only to certain extent
      i. depending on the scope of the RFO/grant call
      ii. transparency about possible societal impact

3. **RFOs should not monitor elements that are already monitored by other institutions, e.g.:**
   - a. what is already framed by international/national legislation
   - b. internal rules of each single institution

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c. RPOs/PIs relations with the sub-contractors (As a matter of principle, RPOs can choose freely their sub-contractors
d. subcontractors, except:
    i. in case of misconduct
    ii. marginal monitoring if needed

Explanation: the points 2 and 3 gather recommendation about what RFOs should monitor or not. High disagreement within the participants about monitoring the societal impact. The disagreement depends on the differences between European and national/local RFOs and between open or stricter calls'

4. **RFOs and RPOs/PIs should maintain a close, cooperative and continuous collaboration during the lifetime of the project**
    a. The monitoring process should balance rigidity and flexibility and take into consideration the specificity of each funded project
    b. the monitoring should help researchers and ensure that they fulfil and comply with the grant agreement
    c. RFOs should help beneficiaries in case of a problem during the lifetime of the project
    d. the monitoring should be done by funders in according to the research center
    e. the monitoring should not overburden both parties, RFOs and RPOs/PI
    f. the scientific and the financial monitoring should be done during the entire lifetime of the project
    g. RFOs should have in place good IT tools to help the monitoring process
    h. RFOs should have in place a system of pre-monitoring (checklist) as a form of informal assessment
        i. RFOs should be able to detect easily (e.g. with yes/no questions) if everything is going well
        ii. RFOs should further investigate the project if something is not clear during the pre-monitoring process

Explanation: The level of collaboration is close related to different parameters such as the lifetime of the project, the capacity of the RFO and the grant budget

5. **The monitoring process should help RFOs and governmental institutions to think about what is the structural problem that makes compliance more difficult for the beneficiaries**
    a. RFOs should check that the RPO/PI is in the position to comply with what they promised to do

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b. monitoring should also aim to help beneficiary in the implementation of the guidelines from all point of views

6. **RFOs should have in place a system of quality assurance system to monitor the monitoring process in order to guarantee transparency**
    a. RFO internal procedures to control step by step the monitoring of the research grant

Compliance with RI requirements

Title of skeleton guidelines:

Guidelines on compliance with RI requirements for research funders

Guidelines:

1. **RFOs should have in place RI-related guidelines, in particular:**
    a. Clear guidelines about what it is expected from the beneficiary
        i. making clear who is responsible for what in the project
        ii. In addition, grant beneficiary should also clearly state who is responsible for what from the beginning of the project
    b. There should be separate guidance for research ethics and research integrity and how to deal with them in relation to the guidance at RPOs
    c. Where possible, assign an ethics or integrity adviser within the project to have an internal monitoring
    d. Pre-agreement between RFO and beneficiary about the what will be monitored is necessary from the beginning
    e. Reinforce the need for compliance with institutional/national code of conduct
    f. On ongoing basis, that needed ethics approvals are available

Explanation: The majority of the participants made clear that a clear distinction between RE and RI is needed. The main problem is related to the diverse understanding of the concepts of RE and RI.

2. **RFOs should have clear guidelines on what should be monitored, what should not and by whom (depending on the capacity of the RFO)**
    a. RFOs should monitor compliance with RI standards
    b. RE approvals
    c. Open access/open data
        i. positive and negative results
    d. supervision/mentoring

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e. data management plan
f. authorship
g. potential COI
h. RI training and certifications (quality of ethics/RI training is difficult to monitor)
i. pre-registration of the study
j. RFOs should NOT monitor the sub-contractors (except when relevant to funding)
    i. RPOs should monitor the sub-contractors
k. the beneficiary should be able to freely manage its relations with all stakeholders involved, unless:
    i. it is a co-funded project with the involvement of commercial partners

Explanation: Even if there was disagreement among participants concerning different sub-points, we decided to keep all suggestions made during the CCWs

3. **RFOs should support a better RI culture and infrastructures**
    a. RFOs should promote a RI culture and create a more supportive environment for researchers
    b. The RPO is responsible to promote the respect of the guidelines and of RI standards
        i. In addition, the beneficiary is also responsible for respecting the guidelines

4. **RFOs should monitor if investigation procedures in case of RI breaches are in place in the RPO that is hosting the funded project**
    a. The RFO should make sure that RPO/host institution has procedures and structures in place.
    b. The RFO should be informed as soon as possible about the breach, the investigation and its outcomes
    c. Clear procedures and consequences need to be in place in case of misconduct, e.g. stop available funding and clarify consequences in terms of future funding

Explanation: Different views about the level of involvement of the RFO in case of allegation of misconduct. Main differences between European and national organizations

Financial monitoring

Title of skeleton guidelines:

Guidelines on financial monitoring for research funders

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Guidelines:

1. **RFOs should have clear guidelines for financial monitoring**
    a. The RFO should have clear guidelines about the level of financial management required
    b. Before the start of the project, a mutual agreement between the RFO and the beneficiary has to be in place regarding
        i. financial monitoring
        ii. financial requirements
        iii. exceptions
        iv. appropriate timeline
    c. The RFO should monitor if the funding is well managed by the RPO
        i. financial monitoring should be done by a dedicated office (depending on the RFO capacity)
    d. RFO should have a dedicated office for complaints
    e. RFO should check if the money goes to the researchers
    f. RFO should be aware of the level of support the host institution can give to the grant beneficiary

Explanation: The level of the financial monitoring depends on the size and capacity of the RFO

2. **Financial monitoring should take place in parallel with the scientific monitoring by a dedicated department**
    a. clear guidelines about the interaction between financial and scientific monitoring should be in place
    b. a dedicated department should be in charge of linking the two
    c. the project manager should also have a financial overview

Explanation: the implementation of this recommendation depends on the size of the RFOs

3. **Financial monitoring should NOT be linked to the research outputs:**
    a. If the research outputs are a part of the work plan it needs to be monitored
    b. The monitoring should be independent of positive or negative results and of publications
    c. Societal relevance is normally not linked to the financial monitoring

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Explanation: In this case, a strong disagreement among participants about the link between the financial monitoring and the societal relevance.

4. **Compliance with the initial financial plan is mandatory**
    a. compliance with the grant agreement needs to be ensured
    b. while some flexibility in terms of deadlines can be allowed, all deviations from the initial plan have to be justified
    c. annual report procedures need to be in place
        i. not monitor in detail the travel expenses
        ii. not monitor the subcontractors

5. **RFOs should use financial monitoring also in relation to RI breaches**
    a. to prevent financial fraud
    b. RPOs/PIs should report timely possible financial amendments
    c. Withdrawal of funding would only happen if the RPO/PI failed in its responsibilities
    d. Clear communication between the scientific and the financial department is essential

Final considerations: The implementation of the guidelines is strongly dependent on the type of the RFO and the country where the RFO is based. Small and south/east RFOs might encounter several difficulties in implementing the guidelines.

The formulation of RFO-related guidelines is made difficult due to the too many variables related to country differences, the size of the RFO, if the RFO is national or international, private or public and disciplines specific.

We tried to report all ideas, doubts, suggestions from our participants, rather than make a selection of them.

The aspect of the societal impact is dependent on the typology of the RFO and the typology of the grant call.

4.2.2.2. Selection and evaluation of funded application

<u>Research integrity plan</u>

Title of skeleton guidelines:

Guidelines on RI plan for research funders

Guidelines:

1. **RFOs should have guidelines and a framework for those assessing RI plan**
    a. RFOs should provide guidance to panels on how to review RI
        i. important to instruct panel member on what and how to assess
        ii. RFOs should document in their processes how assessment panel members are instructed
    b. training for those assessing (what by whom)
    c. considering national differences about different RI understanding
    d. it is important to have a special review panel with specific RI expertise

Explanation: although taking account of national differences is very important, the task might be difficult to implement in practice for RFOs

2. **RFO should have research integrity policies to support their projects or establish procedures with RPOs**
    a. logistic support about preparing the RI plan
    b. creation of templates with best practices and examples

3. **RFOs should duly take into account country/regional differences**
    a. differences about RI awareness and legislation
    b. guidelines difficult to implement in some countries because of national specificities. A support could be to provide:
        i. step by step process with a priority list
        ii. guidelines about how to implement
    c. important to achieve a general understanding beyond country differences, e.g. international dialogue template

Explanation: same as in point 1, although taking account of national differences is very important, the task might be difficult to implement in practice for RFOs

4. **RFO should ensure that there is a plan for RI training**
    a. RFO is NOT responsible in providing training
        i. RFO can suggest and recommend some RI trainings
        ii. RFO should ensure there is a plan for training
    b. RPOs are responsible for the training
        i. RI and DMP training are responsibilities of the RPOs
        ii. training has to be relevant for dealing with RI issues related to the project
        iii. it is important to define who delivers the training
            a. who is responsible for the training? host RPO/PI/consortium?

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c. Completion of RI training should be done within a year after starting of the project
    i. Completion of training before presenting the application is not always feasible because of institutional and country differences
    ii. RFOs should however push RPOs to have RI training in place within a reasonable time
    iii. RE/RI training certificate should be attached to relevant documentation
d. There is need for standardization, e.g. national/international RI plan template
    i. EU certification might be relevant despite the difficulties to put into practice

Explanation: the discussion about clarification of responsibilities (who is responsible for what) was very important for participants in the workshop

5. RI plan specific requirements

a. There should be a clear distinction between RI and RE
b. There should be a clear definition of responsibilities and who is responsible for what
c. RI requirements should be highlighted according with the research methodology used within the project
d. The DMP can be completed after receiving the grant
    i. usually after 6 months

Explanation: Same as in point 5, the discussion about clarification of responsibilities (who is responsible for what) was very important for participants in the workshop. Despite recognizing that point 5a is not easy to clarify in practice, participants emphasized its importance.

6. RFOs should require a plan for how to prevent RI breaches

a. The RFO could have a specific section in their application forms that is dedicated to RI and that requires the RPO or PI to write a research integrity plan where they discuss:
    i. What RI training they will access/provide for their research team and when (needs to be completed within the first year)
    ii. How they will ensure responsible research practices such as preregistration, data analysis plans, the use of preprints, the assurance of open science practices, how to deal with responsible authorship guidelines, how to implement and comply with the FAIR principles (Findable, Accessible, Interoperable, Reproducible), how applicant/host RPO assures open data/ open access
    iii. How early career researchers will be mentored
    iv. How data management plans are constructed and how data is managed

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v. If applicable, how the applicant is safeguarding good laboratory practices
vi. How the applicant plans to assure RI in the dissemination and use of the outputs, knowledge and discoveries that the proposal might generate to have as much impact as possible. Researchers should explore ways to do this both within and beyond academic routes.
vii. How the applicant plans to deal with breaches of RI and what supporting policies and processes are in place in the RPO to deal with misconduct (the applicant)
viii. plan for effective RI monitoring by the RPO/for the PI

Explanation: Guideline 6 was discussed in first set of workshops not directly in the second round.

Methodological requirements

Title of skeleton guidelines:

Guidelines on methodological requirements for research funders

Guidelines:

1. **RFOs should have clear guidelines and rules about the evaluation process**
    b. clear guidelines about the definition of the evaluation criteria
        i. clear definition of RI-related challenges
    c. clear guidelines for the assessment (evaluation guidelines)
        i. checklist for evaluators
        ii. inclusion of best practices
    d. RFOs should have in place clear guidelines on how to evaluate the methodology
        i. RFOs should assess proposals on the quality of the research methodology. This must be rigorous and well-planned to ensure that results are as robust and unambiguous as possible, and to enable reproducibility/replicability of studies.
        ii. The methodology part is usually assessed under research quality and not under RI plan.

Explanation: Participants in the workshops discussed that generally RFOs should ensure that there is no overlap between methods per se and concerns about RI with regards to methods.

Point 1c was discussed only during the first set of workshops therefore seems to be slightly different in rationale if compared to point 1a and 1b.

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2. **RFOs should include a methodology section in the proposal that should include, for example (depending on the discipline):**
    a. Guide for specific parts related to RI and RE in the methodology
        i. specifically, in relation to RI
    b. checklist of priorities for the review process
    c. Protocols and methods well established and described (pre-registration)
    d. a description on how to deal with study (pre)registration before the study is conducted.
    e. the extent to which the applicant and their team have had methodological training or have extensive methodological experience, which should be detailed in this section
    f. A methodological training plan for junior researchers and the entire team
    g. If applicable, methodological plans should include how results will be reported and which reporting guidelines are being used
    h. If applicable, research methods should emphasize how they deal with potential gender differences in their study population
    i. If applicable, researchers must describe how they will access advice and guidance from the clinical research infrastructure in the host RPO.
    j. If applicable, applicants must describe how potential methodological biases are addressed in the study.
    k. If applicable, the methods should justify the statistical tests being proposed to determine adequate power, sample and group size
    l. The methods should include a description of how bias in data collection and analysis will be managed.
    m. When using animals, tissues or cells, researchers must describe how they will determine the appropriate sample sizes, controls and replicates in their studies.
    n. Researchers should describe how they plan to maintain accurate records of their methodologies, procedures and the approvals granted during a project. These should be reported clearly in any publications to enable the study to be repeated Control and reproducibility plan)
    o. Research records or laboratory notebooks should include clear cross-referencing to electronic data sources (such as data repositories).
    p. Where appropriate, the literature search should be included
    q. How the RPO will describe their standard procedures for signing off and archiving laboratory records and notebooks.

Explanation: This part is too detailed. Points c to p are a result of the first set of workshops.

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3. **Guidelines should take into account country differences**
    a. However, the guidelines should balance the level of details (not too general/not too detailed)

Explanation: as in previous guidelines, participants highlighted the need to balance specificity (country differences) with feasibility (too many details).

4. **Guidelines for the assessment of the data management**
    a. during the interim evaluation and not in the selection
        i. it cannot be assessed in the application
    b. clear definition of the criteria of evaluation
    c. DMP training and mentoring is needed

5. **An equal treatment should be ensured in follow-up interviews**
    a. to ensure an equal treatment, all the applicants or no one should be interviewed
        i. depending on the capacity and size of the RFO, interviews can be organised for all shortlisted applicants
    b. interviews cannot focus only on specific parts but need to be general, e.g. not just for the methodology section

Explanation: Partcipants in the workshop emphasised the principle of fair treatment.

Diversity issues

Title of skeleton guidelines:

Guidelines on diversity issues for research funders

Guidelines:

1. **RFOs should support diversity in the application**
    a. First of all, a merit-based evaluation process needs to be ensured
        i. minorities/ less represented groups can be taken into account/prioritised in case of equally ranked proposal
    b. A general acknowledgement of diversity can be recognized without taking it into consideration in the evaluation process
        i. No disclosure of personal, sensible, confidential information can be allowed under the umbrella of ensuring diversity, e.g. sexual orientation questions
    c. RFO should provide guidance on diversity

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d. The RFO requires submitted research proposals to include a gender and diversity statement regarding a) the researchers in the call and b) when applicable, the researched population.

Explanation: point 1d is from first set of workshops therefore it can sound slightly from the other points.

2. **The RFO has regular monitoring in place to examine whether their organisational structures and processes are susceptible to potential diversity issues.**
    a. If so, the RFO will develop and implement a plan to mitigate any identified diversity issues. It is crucial that the RFO's leadership commits to this plan, sees it through with appropriate encouragement, support and initiatives, throughout the organisation.

3. **The RFO will undertake action towards eliminating the pay gap and monitor progress, examining bias as a contributing factor to pay gap.**
    a. The RFO will monitor precarious contracts and part-time positions for any gender-based differences and correct any inequalities. RPOs should examine conditions for part- time positions for researchers and their gendered division.
    b. Pay gap measures are NOT the responsibility of RFOs
    c. Pay gap measures are responsibility of the RPOs
    d. Pay gap measures need to be addressed at national level

Explanation: There is some disagreement between first set of workshops (point a) and second set of workshops (points b to d) concerning the degree of responsibility for RFOs concerning the pay gap which is normally a national/RPO responsibility

4. **The RFO should ensure that the language used to communicate to grant applicants is inclusive:**
    a. The RFO commits to closely monitor potential bias in language used in recruitment processes and funding calls.
    b. RFOs should guarantee clear guidelines in all official/non-official languages present in the area of the call
    c. All possible main languages in the region need to be taken into consideration

5. **RFOs should ensure/promote diversity within the internal staff and evaluators**
    a. RFOs should avoid possible biases
    b. RFOs should promote transdisciplinarity

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c. RFOs should make sure that evaluators and committees are briefed on bias and COI before the evaluation
d. Gender diversity should be ensured in assessment panels

6. **RFOs should provide training and good guidelines on how to recognize and avoid diversity-related bias**
    a. COI training is needed as part of bias training

7. **RFOs could foresee dedicated calls for specific minority groups e.g. juniors and women**
    a. A merit based evaluation system should however be the reference point

Explanation: There was some disagreement among participants concerning at what degree minority groups need to be encouraged while ensuring merit.

8. **Recruitment and/or funding processes should be as open and transparent as possible and be genuinely merit-based.**
    a. This includes measures such as briefing selection committees about bias pitfalls,
    b. deciding unclear selection criteria at the outset,
    c. letting external observers monitor the selection process
    d. and involving external evaluators

Final considerations:

In general, the guidelines are too detailed if we require funders to implement them. A balance will need to be found between prescription and feasibility.

The implementation of the guidelines is strongly dependent on the typology of the RFO and the country where the RFO is based. Small and south/east RFOs might encounter several difficulties in implementing the guidelines.

The formulation of RFO-related guidelines is made difficult due to the too many variables related to country differences, the size of the RFO, if the RFO is national or international, private or public and disciplines specific.

We tried to report all ideas, doubts, suggestions from our participants, rather than make a selection of them.

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4.2.2.3. Independence

What counts as an unjustifiable interferences

Title of skeleton guidelines:

Guidelines on what counts as an unjustifiable interferences for research funders

Guidelines:

1. **RFOs should have an extensive description/definition of interferences**
    a. clear description should be publicly available online
    b. listing all possible positive and negative interferences
        i. using case studies as examples
    c. the internal staff should have available clear guidelines on how to deal with possible interferences
    d. Interferences by third/external parties with the selection and evaluation process of proposals are not justified
    e. Interferences by RFOs during the evaluation and selection process of the proposals is justifiable in case of breaches of integrity
    f. In general, blocking the publication of certain data and interfering with the publication process is unjustifiable, unless specific conditions are foreseen
    g. Interferences with the preselection of the proposals or with the expected outcomes of researches depending on political orientations are unjustifiable
    h. Preselection of topics is justifiable in case the money (public or private) is allocated for a specific purpose/objective
    i. In general, changing deadlines is not allowed unless specific conditions are foreseen. Changing deadlines is allowed in case of specific unpredictable events (e.g. COVID-19)
    j. RFOs can interfere in case of possible breaches of integrity during the evaluation and selection process, the monitoring of the projects and during and after the publication process

Explanation: All participants agreed on the fact that all interferences have to be stated clearly to avoid all possible misinterpretations. In addition, interferences can be understood as justifiable or unjustifiable depending on the cultural background

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2. **RFOs should take into consideration all possible external interference during all phases of the grant process**
    a. listing all possible interferences at all possible stages/level of the evaluation process
    b. the whole evaluation process has to be as transparent as possible
    c. RFOs should have clear guidelines for the evaluators, including a briefing session before starting the evaluations
    d. evaluators have to disclose all possible positive and negative COIs
    e. special attention should be given to collaboration with industry sponsors, political requests and other external parties

3. **RFOs themselves should take enough distance from all evaluations related to the proposals**
    a. RFOs should have in place a regular review of the selection process
    b. RFOs should have in place internal policies for the staff members
        i. staff members should disclose all possible COIs
        ii. RFO staff should not give unfair advantages to the applicants

4. **RFOs should take into account diverse considerations/differences when developing a definition of unjustifiable interference**
    a. in general term, RFOs should take into consideration cultural, national, institutional and local differences
    b. National RFOs should take into consideration institutional differences concerning the management of funded projects
    c. International RFOs should take into consideration national differences concerning different legislations or guidelines related to RI

5. **RFOs should have in place a Conflict of Interest Policy in order to avoid interference by third parties:**
    a. COI checklist attached to the application
    b. COI checklist for reviewers and panel members
    c. financial COI checklist
    d. Disclosure of all possible COI during all phases of the evaluation process
    e. disclosure of all possible COI during all phases of the projects

Preventing interferences by the funders

Title of skeleton guidelines:

Guidelines on preventing interferences by the funders for research funders

Guidelines:

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1. **RFOs should commit to refrain from unjustifiable interfering with any research process**
    a. all procedures have to be as transparent as possible
    b. the size and the capacity of the RFO have to be taken into consideration
    c. RFOs should guarantee diversity and a rotation system of evaluators to avoid as much as possible COI and interferences
    d. RFOs should make available the list of reviewers and evaluators

Explanation: All participants agreed that transparency in all the procedures has to be guarantee.

2. **RFOs and all staff members shall maintain impartial and independent:**
    a. in formulating research agendas
    b. in setting out calls
    c. in the selection process of the proposals
    d. in monitoring research, after the research is presented
    e. by publishing all internal procedures
    f. by ensuring evaluations by a panel of peers
    g. by complying with existing international guidelines, e.g. DORA or Leiden Manifesto
    h. and all other aspects of research

Explanation: Regarding the sub-points a and b, participants highlighted the role of the government in setting out the research priorities. Impartiality and independence depend on the typology of the RFO (public or private) and the typology of the grant call (co-funded by commercial entities or not).

3. **Potential interference will be regularly assessed by the RFO in several stages of the research process using a checklist/declarations of all possible interferences by all stakeholders involved in the call**
    a. in the selection of the proposals
    b. in the monitoring of the proposals
    c. in the final reporting

Explanation: The level of control depends on the approach used by the RFO. A more trust-based approach would diminish the level of control of potential interferences

4. **RFOs should have in place transparent procedures on all possible Conflicts of Interest within the funding agency or between the evaluators/reviewers and the applicants**
    a. including financial COIs that have to be published by the RFO

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5. **RFOs should guarantee a pool of independent and international experts/reviewers/evaluators in the selection and evaluation of proposals, to ensure impartiality and transparency (the implementation of this recommendation can be difficult for small RFOs)**
    a. self-declaration of all possible COIs
    b. ensuring diversity within the evaluators (gender, country, disciplines, expertise)
    c. ensuring a rotation system for reviewers
    d. all names (of who?) have to be publicly available

Explanation: The involvement of international evaluators depends on the size of the RFO and its reputation.

6. **All RFO procedures should be publicly available to ensure transparency**
    a. RFOs should have in place a quality assurance system and monitoring system to ensure transparency

7. **RFOs should not interfere with the publication plan proposed within the proposals**
    a. publication in open access has to be the main option
    b. Public access to all data
    c. RFO has to take into consideration institutional and national policies
    d. unless it is contractually defined a priori

8. **RFOs should have in place training for the internal staff**

Preventing influence from political/other external influences

Title of skeleton guidelines:

Guidelines on preventing interferences from political/other external influences for research funders

Guidelines:

1. **Clear, transparent and open communication should be in place between the different stakeholders in the selection of the priority (e.g. selection of the topics to grant)**
    a. Different/external stakeholders should be involved in setting priorities concerning the allocation of the money
    b. the criteria for the selection of the priorities have to be specified
    c. open discussion between the government (involving all ministries) and the RFOs

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d. the set of priorities has to be defined also through a public hearing with the involvement of scientists

2. **RFOs should be independent from political and external influences**
    a. RFOs should maintain an intermediary position between the government, researchers/research institutions, the press and other stakeholders
    b. RFOs should have an independent/international board in order to prevent any possible political/external interference
    c. To avoid interference by third parties, RFOs should have in place sound, detailed, step-by-step and transparent procedures
    d. to avoid the exclusion of topic taboo from the research agenda
    e. RFO should maintain an independent position within the evaluation process
    f. to avoid political interferences, RFOs have to take into consideration national/regional/local interferences

Explanation: The typology of interference can be different depending on the country and cultural background. Moreover, political interferences at national level might be not the only ones. Depending on the country, regional or local political interferences might be stronger than national ones.

3. **The committee members of research funding programs should be regularly screened for potential political interference**
    a. a collective control system should be implemented
    b. strict rules should be applied to governmental employees regarding COI
    c. RFO committee members (decisional board) should not be part of the political system
    d. political COIs should be integrated within the list of the COI

Explanation: The participants debated about the feasibility of a political screening. This typology of screening can be very challenging and difficult to achieve. The implementation of the recommendation also depends on the typology of the national government in charge

4. **RFOs should have in place a clear communication procedure to avoid communications with politicians about the results before the results are presented to the RFO**
    a. communication to the public should run through official communication channel of the RFO

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5. **RFOs should (ideally) allocate their money freely without political/external/commercial interference unless.....**
    a. specific research priorities have been already set
    b. specific calls
    c. specific allocation of money depending on disciplines

6. **RFOs should have in place specific trainings for the internal staff on how to detect political interferences**
    a. In order to avoid political interferences, RFOs have to take into consideration national/regional/local interferences

Explanation/final consideration: The sub-topic related to the political interferences was the most challenging and debated. During both co-creation workshops was highlighted how national, regional and local differences might play a role in the definition of a guideline and in its following implementation

Preventing interferences from commercial influences

Title of skeleton guidelines:

Guidelines on preventing interferences from commercial influences for research funders

Guidelines:

1. **Clear guidelines about commercial collaborations/ co-financing projects with external-commercial partners should be available**
    a. about how to make the decision process independent from commercial influences
    b. transparent allocation of public/private funding has to be guaranteed
    c. specifying the nature of the commercial partner
    d. clear definition of the funding scheme is needed to define the guidelines
        i. distinction between co-funding and other typologies of commercial funding when institutions collaborate in the project
    e. conduct or sponsor research that is factual, transparent, and designed objectively; according to accepted principles of scientific inquiry, the research design will generate an appropriately phrased hypothesis and the research will answer the appropriate questions, rather than favor a particular outcome;
    f. require control of both the study design and the research itself to remain with scientific Investigators
    g. not offer or accept remuneration geared to the outcome of a research project;

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h. prior to the commencement of studies, ensure that there is a written agreement that the investigative team has the freedom and obligation to attempt to publish the findings within some specified timeframe;
i. require, in publications and conference presentations, full signed disclosure of all financial interests;
j. not participate in undisclosed paid authorship arrangements in industry-sponsored publications or presentations;
k. guarantee accessibility to all data and control of statistical analysis by investigators and appropriate auditors/reviewers; and
l. require that academic researchers, when they work in contract research organizations or act as contract researchers, make clear statements of their affiliation; require that such researchers publish only under the auspices of the contract research organizations.

2. **Clear collaborative contracts in all phases with commercial partners should be available**
    a. the contract has to be available since the beginning of the project
    b. clear definition of the role of each partner
        i. detailed enough to cover all possible situations
    c. clear description of the objectives of the research
        i. detailed enough to cover all possible situations
    d. in the case of confidential research, there should be transparency and it should be clearly stated where and when commercial partners have a say in the research
    e. before starting the project and before getting the funds, a collaborative contract among partners has to be signed
        i. ensuring that the RPO has the capacity to engage in this kind of contract

3. **RFOs should have in place clear COI procedures**
    a. in the selection of the topics
    b. in the application assessment
    c. in the monitoring process
    d. checklist of all possible COI from both sides
    e. clear procedure on how to manage COI

4. **RFOs should have in place a system of monitoring of the collaboration contract and its compliance**
    a. RFOs should make a pre-check of the contract

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5. **RFOs should guarantee no interference in the publication process**
    a. an early agreement about the publication of the data has to be in place
        i. important to define who is the project owner
    b. transparent procedures regarding the publication of the data
        i. balance between open science and intellectual property rights
    c. clear guidelines to avoid interferences in not publishing non-favorable data
    d. the publication process can be delayed for intellectual property protection

Final considerations: The implementation of the guidelines is strongly dependent on the typology of the RFO and the country where the RFO is based. Small and south/east RFO might encounter several difficulties in implementing the guidelines.

The formulation of RFO-related guidelines is made difficult due to the too many variables related to country differences, the size of the RFO, if the RFO is national or international, private or public and disciplines specific.

We tried to report all ideas, doubts, suggestions from our participants, rather than make a selection of them.

5. Quality assessment system for the inclusion of tools in the toolbox

5.1. Background of previous steps leading to the online toolbox

In previous empirical steps, we collected 137 guidelines and SOPs from the systematic scoping review, the Delphi study, and the focus group interviews (see deliverables D3.1, 3.2, 3.4, and 5.2 for more details). All documents were classified per sub-topic(s), and their quality was assessed by two independent reviewers (note that this initial quality assessment is separate from the main quality assessment used in later stages and described below). The reviewers gave each document or section of documents a score on a scale from 1 to 5. A score of 1 indicated 'no existing/no information or very scarce and not useful', a score of 3 indicated 'there is guidance and some information on the topic, but not very structured or complete', and a score of 5 indicated 'detailed and clear guidance on a topic' (see D4.2). When discrepancies were detected these were discussed until consensus was reached.

The retrieved set of documents and SOPs found in these earlier steps will be the basis of the creation of a repository. Hereafter, all tools in the repository will be quality assessed (see below) and the tools that have a sufficient quality level will be included in the toolbox. Document included in the toolbox will be described with tags and general characteristics to help users rapidly find relevant, high-quality

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documents. Box 1 provides an example of the presentation of the general characteristics and information of a resource to be included in the repository, while Box 2 displays the tags to be included on each repository items.

General characteristics

1. Title to present the resource at the Toolbox (NOT necessarily the original title of the resource – up to 20 words)
Example: A procedure to render a replication study as effective as possible.

2. Purpose/Aim of the resource (up to 50 words)
Example: To establish a procedure that is called "precommitment", agreed between the authors of a peer reviewed scientific publication and replicators that will render a replication study to be conducted in an effective and collaborative manner.

3. Text of the resource (the exact content as found transformed in plain word format – up to 200 words)
Example: Failure to replicate often brings intellectual gridlock. Some researchers insist that a replication refutes the original paper's ideas; others find flaws in the reproduced work. Both replicators and original authors defend their conclusions — or at least their competence — rather than getting on with the difficult, intellectual work of using new evidence to revise ideas. Human nature and the academic incentive system make it hard to do otherwise. How can researchers avoid such stalemates? We need to spend more time early on resolving what is to be tested, the crucial features for doing so and the insight we expect. We need a process that appeals to our better natures, or at least requires that we reveal our lesser selves. The approach should favour seeking an accurate answer over defending previous results. We call it precommitment. After a paper is made public, but before it is replicated, the original authors and independent replicators collaborate to design a replication experiment that both agree will be meaningful, whatever the results. This process will be documented using preregistration or, ideally, a Registered Report (see 'Routes to replication').

4. Link of the resource (if available)
Example: https://www.nature.com/articles/d41586-020-02142-6

5. Reference of the resource
Example: Brian A. Nosek & Timothy M. Errington "Argue about what a replication means before you do it" Nature 583 (2020) 518-520.

6. Which SOPs4RI Topic(s)/Subtopic(s) does the resource cover?
Example:

- *RPO Topic: Research environment*
- *Subtopic: Supporting a responsible research process (transparency, quality assurance, requirements)*

Box 1. Example of descriptions of characteristics of an item included in the repository.

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Tags will include

1. Which of the following best describes the resource?
- SOP
- Guideline
- Case study/example

2. Which discipline(s) is the resource relevant for?
- All
- Social Sciences
- Humanities
- Biomedical
- Natural Sciences/Engineering

3. Which stakeholders is the resource relevant for?
- Pre-graduate students
- Post-graduate students
- PhD candidates
- Early career researchers
- Senior researchers
- Researchers in industry
- Supervisors
- Tenured faculty members
- Research administrators
- Members of Research Ethics Committees
- Members of Research Integrity Offices/Bodies
- RPO senior management staff (Rectors, Deans)
- Members of RPO research committees
- Ombudsmen
- Funders
- Technicians in RPOs
- RFO employees
- Editors
- Publishers
- Peer reviewers
- Policy makers
- All stakeholders of scientific research

Box 2. Descriptive tags added to the items included in the repository

5.2. Objective of the quality assessment

To populate the online toolbox of SOPs4RI, we will undertake a second, more in depth assessment of the collected documents in the repository. This second assessment will also be designed and applied on new documents, found after the initial work described in D4.2. These additional documents have been and will be included in the repository based on other empirical steps in the SOPs4RI project. They include a collection of Nature papers, documents referred to in the co-creation workshops, and other relevant documents. The objective of the assessment is to determine which of the repository documents that are of high enough quality to be included into the toolbox (note that this quality assessment is separate and additional to the initial quality assessment described above, cf. D4.2). In addition to this second quality assessment (QA), a set of new classification terms are also going to be assigned to the documents. The aim of these new classification terms is to provide a more nuanced description of the content of the resources.

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5.3. Procedure for building a quality assessment methodology

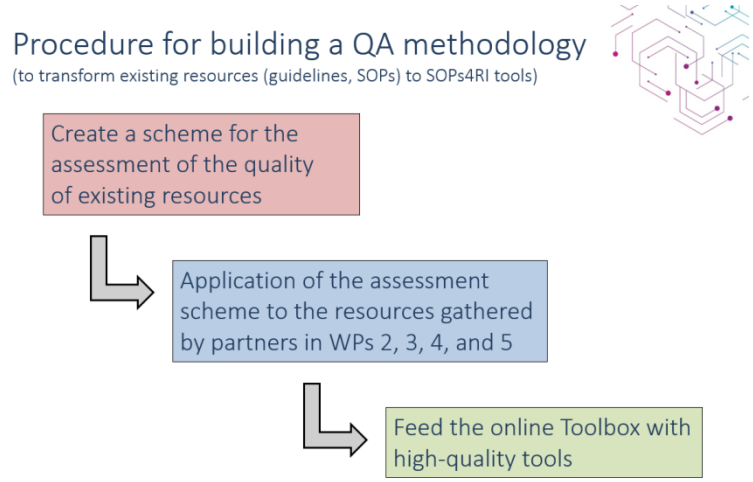

Figure 4: schematic overview of building the QA methodology

The procedure consists of three consecutive stages. First, we created a scheme to evaluate and assess the quality of existing resources in the repository. Hereafter, we developed a method to assess the quality of the documents. Second, in the coming months, we will apply this QA methodology to the resources gathered by partners in WP2, WP3, WP4, and WP5 and stored in our repository at SOPs4RI's SharePoint site. Third, based on the outcomes of the assessment, we will populate the online toolbox of SOPs4RI with high quality tools.

5.3.1. Stage 1: Creating an assessment scheme

To create a robust assessment scheme, we took the following steps. First, we created an initial assessment scheme, based on discussions between four members of the SOPs4RI team. Next, we tested the scheme by assessing 10 documents (5 documents per member, i.e. each document was assessed by two members). We discussed the results of the test and optimized the scheme. The optimization of the scheme included discussing which points should be changed, and how specific issues of the grading scheme should be addressed. Next, the evaluation scheme will be assessed by two independent reviewers, who are experts in developing guidelines. Based on their feedback, the quality assessment scheme will then be revised and finalized. In the next section we describe the proposed assessment scheme.

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5.3.1.1. Quality assessment

The quality of a resource is assessed through a grading system that includes four quality parameters describing the user friendliness, the rigorousness and the comprehensiveness of each resource (Box 3). The quality assessment will be used for internal purposes only, and the outcomes will be used to select high quality documents for the SOPs4RI toolbox. Two independent assessors will evaluate a resource – per subtopic – and come to a consensus.

The user friendliness is determined by the parameters understandability and implementability. The rigor and comprehensiveness of the document is determined by the parameters methodological soundness and comprehensiveness. Two independent assessors will rate a document on these four parameters and come to consensus. After scores on all 4 parameters are determined, an average score is calculated. The average score determines whether the resource is included in the toolbox or not. In Table 4, the four parameters and a description of the scores 1, 3 and 5 are given.

User friendliness of the resource

1: Understandability (easiness to grasp the content of the resource)

2: Implementability (easiness to implement the tool)

Rigor and comprehensiveness of the resource

3: Methodological soundness (robustness of the methodology with which it has been created)

4: Comprehensiveness: (Completeness of the tool/coverage of the subtopic in the context of a specific discipline)

Box 3. Detailed assessment criteria for each resource to be included in the repository

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Table 4. Detailed criteria used for assessing the resources

	1	3	5
Understandability	The content of the resource is difficult to understand. The resource presents conflicting information, uses confusing language and has unclear terminology.	The content of the resource can be understood for a large part. The resource does not present conflicting information, presents the information in understandable language and has clear terminology most of the times.	The content of resource is very easy to understand. The resource presents extremely coherent information, presents the information in very clear and understandable language and uses the appropriate terminology
Implementability	The content of the resource is presented in such a way that it cannot be easily implemented by the end-user	Some of the information can be easily implemented by the end-user, some of the guidance is difficult to implement by the end-user	The resource is well-structured and very easy for the end-user to implement
Methodological soundness	The process used to develop the resource is of poor quality or is not reported	The process used to develop the resource is of medium quality	The process used to develop the resource is robust and of high quality
Comprehensiveness	The resource does not present cover the information relevant for the sub-topic at all.	The resource presents a partial image of the sub-topic but provides relevant information most of the time.	The resource covers the sub-topic fully, considers different settings and provides a full image of all issues related to the sub-topic.

It should be noted that, in line with our proposed criteria, guidelines that are tailored to a specific discipline cannot receive a 5 on comprehensiveness. In these cases, the tag of the discipline needs to be added, and for that discipline, the resource can still receive a 5 on comprehensiveness.

To visualize the outcome, a radar chart or dot system will be used. The visualization will be used for internal purposes and analyses only.

5.3.1.2. Classification

In addition to the QA scheme described above, a few additional classification points will be used internally to describe the nature of documents included in each topics. The classification is especially useful to be able to describe the content of the toolbox, and, at a later stage to enrich the functionalities of the online toolbox.

General versus specific: topic specific versus sub-topic specific

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The documents will be classified to topic specific or sub-topic specific, based on the Delphi ranking. Topic specific documents describe information about a specific topic, and include several sub-topics. and sub-topic specific documents only cover a certain sub-topic.

Descriptive versus concrete

Concrete documents provide concrete/explicit measures. Descriptive documents set a framework and/or implicit measures or provide information on a topic.

Normative versus aspirational

The normativity of the documented is measured in the language used and in how strongly recommendations are prescribed. Aspirational documents set out aspirational measures, and often include or explain principles.

Rigid versus flexible

Flexible documents leave room for flexibility in using the guidelines or provide different options. This is, for instance, relevant for setting up research ethics committees which should account for different situations or institutions. Rigid is when only one course of action can be followed or should be adhered to. For example, when following procedures for breaches of RI this is relevant. This classification is not applicable to all documents.

Mandatory versus optional

Mandatory documents enforce the implementation of the guidance. In optional documents, the choice for implementation measures remains open.

Visual versus textual

Visual documents use images or other visual elements to convey the message. Textual documents only use text to set out the guidelines.

5.3.2. Stage 2: Workflow in evaluating new tools

Since we have to have a procedure in place to assess existing tools that came to our attention and new tools that have been published. We have crafted a workflow in order to assess these new tools and make an informed decision whether they should be part of the toolbox and why. For this procedure we describe several steps below:

1. Set up a Quality Assessment (QA) team to undertake the quality assessment and classification of tools on a regular basis.
    a. The assessment team will be given access to the repository on the SOPs4RI SharePoint
    b. The QA-team will create a schedule and arrange a method on how they divide the tasks of assessment on a regular basis

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2. All consortium members can add tools in order to have them assessed by the QA-team. They can add these tools on Sharepoint on a designated QA-database. After adding the tool, the QA-team gets a notification that a new tool has been submitted for assessment
3. The resources that are in the repository, ready for assessment, should then be divided between the QA-team so that each resource is assessed and classified with tags by two different assessors.
4. Assessors of the QA-team should independently assess each resource according to the assessment scheme (i.e., Table 4) and classify it with the classification tags (i.e., *Box 2*).
5. Whenever a subtopic has less than 3 tools included in the repository, the QA-team should look for additional tools or references to include in the repository. These may include:
    a. Resources from the Nature collection
    b. Additional resources from external sources
    c. Documents from other empirical steps of the SOPs4RI project (e.g. the co-creation workshops skeleton guidelines)
6. After completing the assessment and classification for all resources in a specific sub-topic, the two assessors should compare the quality assessment score and the tags attributed to the resource. For each resource, they should come to an agreement on the tags that will be selected, and should calculate an average of the quality scores attributed. This score should be shared in the database for internal purposes only.
7. Only resources with a quality score of 4 or above can be included in the toolbox, unless the subtopic contains no resource with such high quality scores. In subtopics where no resource with quality scores ≥4 are present, resources with a lower quality score should be presented with caution.
8. The QA-team will then make decisions on which tools should be highlighted in the toolbox and which tools are nice to have, but not in the top 3 of most qualitative documents available.
9. The assessors should identify the final set of resources to be included in the toolbox. The QA-team will have a database with the collection of all tools including assessment scores.

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5.3.3. Step 3: Feeding the toolbox with documents from the repository

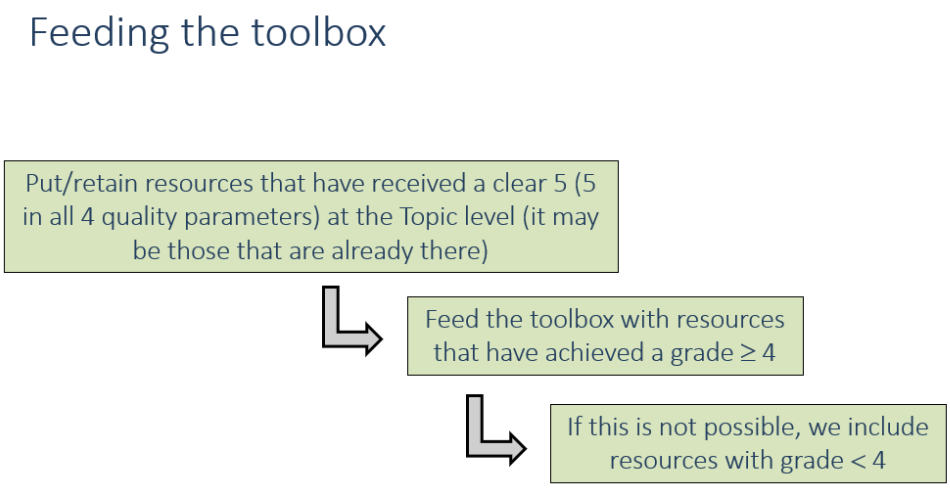

Figure 5. Steps involved for feeding resources in the toolbox

1. Retain resources that have received a clear 5 at topic level
2. Feed the toolbox with resources that have received a grade 4 or above
3. If this is not possible, include resources with grade <4

5.3.3.1. Practical issues related to step 3

How many documents to be included in the repository from the scoping review, interviews and Delphi?

A quick scan of the document with the rating (1-5) resulted in 100 resources which have received a score of 4 or 5 previously. However, many documents covered several sub-topics, a total estimation is around 40-50 documents to be included in the toolbox, which can be subjected to a more thorough assessment and classification.

How will the assessment be registered?

Registering the documents and classification can be done in multiple ways. Below the two methods:

1. **First: Categorising the resources in an Excel file.**
   The two reviewers will first assess the documents by themselves, and feed the rating into an online excel file, making a rigorous table with all classification and assessment scores listed for each document.
   Pros: schematic overview of the classification and assessment

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Cons: documents and texts are not in one place, no clear overview of which labels belong where (in the text). Requires more work.

2. **Second: the resources on the Embassy of Good Science**
   Add all guidelines to the Embassy and make the repository public. This will be done in a later phase when the toolbox is in a more advanced stage.
   Pros: can add quite a few appropriate labels, such as authors, date. Possibility to save time if we would upload the guidelines to the Embassy later anyway. Links can also easily be added (no need to convert webpages to text/pdf)
   Cons: unsure how we can add the specific assessment criteria listed above in the Embassy, only descriptive. No easy data extraction.

6. **Summarizing reflections**

The SOPs4RI project aims to contribute to the promotion of good research practices and to a culture of research integrity by creating a toolbox to support and guide research performing organisations (RPOs) and research funding organisations (RFOs) in fostering research integrity. With the project reaching its middle point, it becomes evident that the joint efforts and collaboration of the partner institutes is moving in the right direction.

In the first steps of the project, the broad scoping review and the Delphi exercises (WP3) allowed us to identify important topics and subtopics upon which we could build the toolbox. The interdisciplinary focus group discussions (WP5) that followed then helped ensure that these topics accounted for gaps and distinctions between disciplines.

The Sets of Recommendations (SoRs) described in the present document allowed to consolidate the findings of these three early steps and to build an extensive SoRs in which each topic and subtopic were classified, documented, and discussed. A reasoned selection of these recommendations was then pursued further with the co-creation workshops. These included 6 topics and 21 subtopics separated between RPOs and RFOs (see Table 5)

Table 5. Topics and sub-topics directly addressed in the co-creation workshops

RPOs	1. Education and training in RI	a. pre-doctorate b. post-doctorate c. training of RI personnel & teachers d. RI counselling and advice
	2. Responsible supervision	a. PhD guidelines b. supervision requirements & guidelines c. building and leading an effective team

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	7. Research environment	b. adequate education and skills training c. culture building d. managing competition & publication pressure f. diversity issues
RFOs	4. Selection and evaluation of proposals	a. RI plan b. methodological requirements d. diversity issues
	7. Monitoring of funded applications	a. financial monitoring b. monitoring of execution of research grant c. monitoring of compliance with RI requirements
	8. Independence	a. What counts as an unjustifiable interference? b. preventing unjustifiable interference by the funder c. preventing unjustifiable interference by political or other external influences d. preventing unjustifiable interference by commercial influences

The co-creation workshops captured the perspectives of policy experts — including RI officers, policy makers, institutional leaders and researchers — and allowed us to question, detail, and expand on the topics and identified SoRs. In particular, the co-creation workshops allowed us to bring the recommendations to life by providing concrete examples of implementation and best practices. Consequently, the guidelines resulting from these co-creation workshops provide greater granularity and details to the initial SoRs.

However, the co-creation workshops also raised several implementation issues, which may hamper the intended uptake of the toolbox. While these implementation issues will need dedicated attention in future work packages, they also inform us on recurrent tension points that we might otherwise have ignored since they reach beyond the realm of research integrity. Issues around the standardization of research practices, the looming danger of bureaucratic procedures that downplay research integrity aspirations in individuals, the definition of excellence, and pre-university education, for example, were highlighted as necessary thresholds for some of the recommendations to be implemented. Although it is beyond the scope of SOPs4RI to tackle these broad, overarching challenges, identifying them in this early stage will help us remain realistic and grounded in the challenges that currently weigh on researchers, institutions, and research environments.

Added to this grounded perspective, the formation of a repository and the quality assessment of resources in this repository will not only strengthen the credibility of the toolbox, but it will also provide a whole collection of resources and direct examples in which research integrity promoting policies were implemented in practice.

As a result, the three steps detailed in this document (i.e., the creation of the extensive SoRs, the co-creation workshops, and the formation and assessment of the repository before resources are lifted

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over in the online toolbox) contribute to the evolution of SOPs4RI by allowing the toolbox to slowly take shape. It gives us a set of guidelines that are not only informed and documented, but also realistic and concrete enough to be of direct value to RPOs and RFOs.

Despite these advances in the project, we still need to pursue the guidelines and some additional underdeveloped topics further before we have a functional toolbox that covers the most pressing topics that foster research integrity in RPOs and RFOs. In upcoming steps of the SOPs4RI-project, we will assess the content, implementation, generalisability and feasibility of some of our recommendations and accumulated findings by conducting a broad scale survey (WP6) with researchers and other research stakeholders. The survey will help identify differences in perspectives and policies between countries and disciplines, and it will provide information on possible issues that may occur from implementing the guidelines in different sorts of institutions. Findings from the survey will be crucial to building the next version of the toolbox (D4.6) that is going to be tested in real institutional settings (WP7).

7. Next steps in WP4

7.1. Emerging underdeveloped topics

We assessed the quality of existing best practice documents (e.g. guidelines, codes of conduct, SOPs) that were found in the empirical work in WP3. Based on that work, we have created a list of topics and mapped how far each topic has been addressed by existing resources. Based on this mapping, we show that most topics are already highly developed and good quality documents cover them, either because they are addressed by good quality existing resources or because we developed them in greater depth in the co-creation workshops. This also implies that there remains a list of subtopics that are less developed. We produced SoRs for these underdeveloped topics, but since the quality of existing resources was sometimes poor or lacking, the extent to which we will be able to further improve, expand, and granulate these SoRs depends on the next steps of the project.

First of all, we have to know which topics are still underdeveloped. Table 6 and Table 7 showcase the complete selection of topics and subtopics, the level at which they were addressed in existing resources, whether they were addressed in the co-creation workshops, and whether they remain underdeveloped at this stage of the project. Numerous underdeveloped topics have been addressed in the co-creation workshops, either directly as part of the 21 selected subtopics, or indirectly by being brought up by the co-creation workshop participants (for the latter, refer to '(x)' in Table 6 and Table 7), but a few topics still need some attention in future steps of the project. Many of these remaining underdeveloped topics involve topics that were too legalistic to benefit from the co-creation workshop. For instance, declarations of conflicting interest (in appointments and promotions, research evaluations, and consultancy for RPOs) or procedures on dealing with breaches of research integrity at the different levels within RFOs. These topics, and a few more, still need to be

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addressed in future steps of the survey (WP6) or more precisely at the institutional level during the pilot testing of the final toolbox (WP7).

Among the underdeveloped topics that were not discussed in the co-creation workshop, some may be more relevant than others in the elaboration of the toolbox. Keeping the large scope of the project and the toolbox into account, topics that are of general relevance will be given priority over topics that address very specific issues or that risk being dependent on local legislation.

Table 6. Categorization of subtopics for RPOs into four categories. Category 1: high quality existing resources available, no need to discuss in the co-creation workshops; category 2: existing good quality resources, but needs adjustments along the process in WP4; category 3: some low-quality existing resources available; category 4: no existing resources. The column CCW (co-creation workshop) indicates underdeveloped topics that have been addressed in the CCW ('X' means the topic was explicitly discussed in the CCW while '(x)' means the topic was discussed by participants without being introduced directly by the moderators). In the last column, we indicate each sub-topic that remains under-developed (or partly underdeveloped when addressed indirectly in the co-creation workshops).
*We have made the subtopics that are really underdeveloped **bold,** so it is easy to detect for the reader which subtopic is underdeveloped.*
** The sub-topic of 'plagiarism' was not extensively discussed in resources for RFOs, but considering that it was extensively discussed in resources addressing RPOs, it might not require further attention.*
() If the last column answer is between brackets, the means that although this subtopic is potentially underdeveloped, most guidance documents can be used from the topics covered in the RPO topics.

Rank	Topic	Subtopic	Resource category 1	2	3	4	CCW	Under-developed
1	Education and training in RI	a. pre-doctorate		X			X	
		b. post-doctorate		X			X	
		c. training of RI personnel & teachers				X	X	
		d. RI counselling and advice				X	X	
2	Responsible supervision and mentoring	a. PhD guidelines				X	X	
		b. supervision requirements & guidelines			X		X	
		c. building and leading an effective team			X		X	
3	Dealing with breaches of RI	a. RI bodies in the organization	X					
		b. protection of whistleblowers	X					
		c. protection of those accused of misconduct			X			(Yes)
		d. procedures for investigating allegations	X					
		e. sanctions	X					
		f. other actions (including mobility issues)		X				

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4	Research ethics structures	a. set-up and tasks of ethics committees	X			
		b. ethics review procedures	X			
5	Data practices and management	a. guidance and support	X			
		b. secure data storage infrastructure	X			
		c. FAIR principles	X			
6	Declaration of competing interests	a. in peer review	X			
		b. in the conduct of research	X			
		c. in appointments and promotions		X		Yes
		d. in research evaluations		X		Yes
		e. in consultancy		X		Yes
7	Research environment	a. fair procedures for appointments, promotions and numeration	X			
		b. adequate education and skills training			X	X
		c. culture building		X		X
		d. managing competition & publication pressure		X		X
		e. conflict management		X		
		f. diversity issues		X		X
		g. supporting a responsible research process (transparency, quality assurance, requirements)	X			
8	Publication and communication	a. publication statement	X			
		b. authorship	X			
		c. open science		X		(x) Partly
		d. use of reporting guidelines	X			
		e. peer review	X			
		f**. predatory publishing**			X	Yes
		g. communicating with the public	X			
9	Collaborative research among RPOs	a. among RPOs inside/outside the EU		X		(x) Partly
		b. with countries with different R&D infrastructures		X		
		c. between public and private RPOs		X		

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Table 7. Categorization of subtopics for RFOs into four categories. Category 1: high quality existing resources available, no need to discuss in the co-creation workshops; category 2: existing good quality resources, but needs adjustments along the process in WP4; category 3: some low-quality existing resources available; category 4: no existing resources.
The column CCW (co-creation workshop) indicates underdeveloped topics that have been addressed in the CCW ('X' means the topic was explicitly discussed in the CCW while '(x)' means the topic was discussed by participants without being introduced directly by the moderators). In the last column, we indicate each sub-topic that remains under-developed (or partly underdeveloped when addressed indirectly in the co-creation workshops).
*We have made the subtopics that are really underdeveloped **bold,** so it is easy to detect for the reader which subtopic is underdeveloped.*
** The sub-topic of 'plagiarism' was not extensively discussed in resources for RFOs, but considering that it was extensively discussed in resources addressing RPOs, it might not require further attention.*
() If the last column answer is between brackets, the means that although this subtopic is potentially underdeveloped, most guidance documents can be used from the topics covered in the RPO topics.

Rank	Topic	Subtopic	Resource category				CCW	Under-developed
			1	2	3	4		
1	Dealing with breaches of RI	a. RI bodies in the organization	X				(x)	
		b. procedures for breaches by funded researchers			X		(x)	Partly
		c. by review committee members				X		Yes
		d. by reviewers				X		Yes
		e. by staff members				X		Yes
		f. protection of whistleblowers and the accused		X				Partly
		g. sanctions/other actions		X				Partly
		h. communicating with the public	X					
2	Declaration of competing interests	a. among review committee members	X					
		b. among reviewers			X		(x)	Partly
		c. among staff members				X	(x)	Partly
3	Funders' expectations of RPOs	a. Codes of Conduct				X		(Yes)
		b. assessment of researchers				X		(Yes)
		c. education and training for RI				X	(x)	Partly
		d. processes for investigating allegations of research misconduct			X		(x)	Partly
4		a. RI plan				X	X	
		b. methodological requirements				X	X	

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	Selection & evaluation of proposals	c. plagiarism	X		Yes*
		d. diversity issues	X	X	
5	Research ethics structures	a. research ethics requirements	X	(x)	(Partly)
		b. ethics reporting requirements	X		(Yes)
6	Collaboration within funded projects	a. expectations on collaborative research	X	(x)	Partly
		b. research that is co-financed by multiple funders	X		Yes
7	Monitoring of funded applications	a. financial monitoring	X	X	
		b. monitoring of execution of research grant	X	X	
		c. monitoring of compliance with RI requirements	X	X	
8	Independence	a. What counts as an unjustifiable interference?	X	X	
		b. preventing unjustifiable interference by the funder	X	X	
		c. preventing unjustifiable interference by political or other external influences		X	
		d. preventing unjustifiable interference by commercial influences	X	X	
9	Publication and communication	a. publication requirements	X		
		b. expectations on authorship	X	(x)	
		c. open science (open access, open data, transparency)	X		
10	Intellectual property issues	*NONE*	*X*		No

It will not be possible to adress all under-developed topics in the survey. Therefore, WP4 and WP6 will select the most important topics to be addressed in collaboration. Some of the topics addressed in the co-creation workshops will also need to be addressed further in the survey to explore country and discipline differences on a greater scale. In fact, co-creation workshop participants often raised distinctions between countries when discussing the co-created recommendations and guidelines. For example, when discussing diversity and inclusion in research environments, several participants mentioned that, while some countries may be ready to implement advanced recommendations on

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how to target inclusion beyond gender, ethnicity, and disability, other countries will need guidance to create a basic foundation for diversity and inclusion issues to start being considered in research institutions. In this regard, the survey will serve as an important vector to consider the level at which different countries may currently stand on the topics addressed and what are the next steps in implementing our recommendations and guidance.

Furthermore, throughout the co-creation workshops, participants highlighted possible implementation issues, such as unintended consequences of implementing the guidelines or barriers to implementing the guidelines (these results will be discussed further in D4.4). Since the survey also aims to provide information on the implementation of the guidelines and on its cost-benefit, implementation issues will need to be addressed in the survey. Some interesting points to address include the determination of what actors are most important in changing and influencing research integrity policy, what barriers are deemed most important and by what communities, institutions or countries these barriers are mostly encountered.

Finally, the format of the toolbox itself requires further efforts before it can be consolidated. The CCW already provided ideas on the formats that would be most helpful to users, and future steps of the project will need to ensure that these ideas are duly considered. For example, CCW participants mentioned that the toolbox should contain a step-by-step approach with several layers of achievement that can be adapted to institutions with different starting points. Some countries may be more advanced in implementing RI policy than others that are still in its infancy in developing these policies. This idea should be explored further in WP7, possibly by providing priority lists and different layers of achievement in the toolbox. CCW participants also suggested that the toolbox would benefit from accompanying videos. Following this suggestion, we started the production of several research integrity-related videos together with SAGE Publishing where SOPs4RI partners and Advisory Board members will share their experiences and best practices on methods used and on specific research integrity topics, related to their work in SOPs4RI. These videos will raise awareness on the iterative and extensive methodological steps used in developing the toolbox and will help bring the toolbox to life. These recommendations are a good starting point, but directed questions in the survey, and especially feedback from the piloting of the toolbox will be essential in ensuring that the format of the toolbox upholds its aim of being truly helpful to end-users.

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APPENDIX 1. Results from the description of the sets of recommendations (SoRs)

Appendix 1 presents the SoRs captured in the scoping review, the Delphi, and the focus group results. The resulting SoRs are exhaustive since they aims to capture all relevant recommendations for the topics and sub topics selected. As a result, it may happen that recommendations are duplicated between topic or, occasionally, misaligned with other recommendations.

Whenever the recommendation was captured in a resource, we added a link or reference to the resource it came from. We often extract the recommendations textually from the resource to ensure that we preserve the intended meaning. As a result, it may also happen that recommendations have a different style from one another. We reformulated the recommendations when they were too ambiguous to be understood properly, or when they lacked context.

In some occasion, the recommendations arose from empirical findings from earlier steps of the SOPs4RI project. In such cases, we indicate the empirical step they came from (e.g., SOPs4RI focus groups). Recommendations without cited documents or empirical findings were created by the team's expertise and prior knowledge.

In some cases, topics or subtopics are not detailed with recommendations because they already contained several high quality policy documents and we decided that they did not need to be expanded further. In such cases, we add a note stating "*Not included as this subtopic is already covered by several high quality policy documents.*"

On other cases, the recommendation was not explicitly mentioned, but was implied in different ways in the documents consulted. In such cases, we write that the recommendation is a *'presumed recommendation'*, to avoid confusion and increase transparency on the possibility of bias.

In summary, this version of the SoRs is complete and functional for informing the future steps of the project, but it is still a preliminary document that will need revisions for coherence, presentation, and harmony (e.g., citation practices, verb tenses, writing style, etc.)

Sets of Recommendations for the RPOs - final version

1. EDUCATION AND TRAINING IN RI

1a. pre-doctorate training and 1b. post-doctorate training

Objective/approach

a. Objective/approach: framing RCR as the norm for research practice
b. Objective/approach: promoting RI, high quality research, and good behavior

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c. Objective/approach: preventing poor research practices and reducing research misconduct (SOPs4RI focus groups)
d. Objective/approach: creating awareness about the ambiguity of some norms and standards in research practices
e. Objective/approach: promoting public trust and managing the impact of research on society
f. Objective/approach: stimulate a positive attitude to openness
g. Objective/approach: assessing effects of RI / RCR education through diverse measures, e.g. performance (such as decision making in ethics cases), knowledge (such as knowledge of human subjects regulation), climate (such as the extent to which individuals endorse ethical behaviors), products (such as self-reflection exercises), or organizational outcomes (such as a drop in the incidence of ethical violations)
h. Objective/approach: maintaining effective stewardship of the scholarly record (e.g., foster quality peer review, encourage openness and transparency, and ensure adequate corrections of published research) (Fostering Integrity in Research)
i. Objective/approach: empowering and supporting researchers in all of their research activities (SOPs4RI focus groups)
j. Objective/approach: inspiring researchers to follow best research practices and helping them internalize the virtues of RI (SOPs4RI focus groups)
k. Objective/approach: promoting a culture of integrity and reflection (SOPs4RI focus groups)
l. Objective/approach: addressing daily struggles and gray areas in research practices (i.e., questionable research practices) (SOPs4RI focus groups)
m. Objective/approach: knowledge of rules, norms and regulations for the conduct of research (SOPs4RI focus groups)

Content

a. Contents: moral reasoning
b. Contents: authorship (SOPs4RI focus groups)
c. Contents: intellectual property
d. Contents: conflict management (SOPs4RI focus groups)
e. Contents: ethical treatment of human participants and animal subjects (SOPs4RI focus groups)
f. Contents: data management (metadata description, data management plan preparation, copyright and licenses) and protection (SOPs4RI focus groups)
g. Contents: societal impact of research
h. Contents: conflicts of interest (SOPs4RI focus groups)
i. Contents: research collaboration
j. Contents: record keeping
k. Contents: research design
l. Contents: regulatory and ethical approvals
m. Contents: appropriate use of research equipment (depending on discipline)
n. Contents: research ethics (Fostering Integrity in Research)
o. Contents: occupational health and safety (Fostering Integrity in Research)
p. Contents: environmental protection (Fostering Integrity in Research)

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q. Contents: appropriate technical skills and needs for the discipline (Fostering Integrity in Research)
r. Contents: citation practices (SOPs4RI focus groups)
s. Contents: supervision and power dynamics (SOPs4RI focus groups)
t. Contents: research environment (SOPs4RI focus groups)
u. Contents: plagiarism (SOPs4RI focus groups)
v. Contents: confidentiality (SOPs4RI focus groups)
w. Contents: lab work (SOPs4RI focus groups)
x. Contents: open science (SOPs4RI focus groups)

Skills

a. Skills: ability for ethical decision making
b. Skills: understanding stakeholders and systems
c. Skills: identifying value conflicts
d. Skills: responsiveness and ability to construct alternative courses of action
e. Skills: ability to engage in reasoned dialogue or negotiations
f. Skills: understanding how to comply with ethical, legal, and professional frameworks
g. Skills: ability to identify and challenge unintentional bias
h. Skills: knowledge of statistics and experimental design appropriate to discipline to ensure results are robust and reproducible
i. Skills: understanding of how the research undertaken fits into broader research and innovation system

Training form, course format, methods and didactics

a. Training forms: informalized training (SOPs4RI focus groups)
    a. Discussions (SOPs4RI focus groups)
    b. Counseling & advice (SOPs4RI focus groups)
    c. Learning by doing (SOPs4RI focus groups)
b. Training forms: formalized training (i.e. RI courses) (SOPs4RI focus groups)
c. Course format: multiple approaches can be applied and combined
    a. Stand-alone courses
    b. Workshop series
    c. Ethics integrated across curriculum
    d. Web-based modules
    e. Laboratory-based interaction
d. Course format: online formats should not stand alone (particularly when evaluated by passed/failed), but should be combined with other formats
e. Course methods: discussions (SOPs4RI focus groups)
f. Course methods: case studies (SOPs4RI focus groups)
g. Course methods: games (SOPs4RI focus groups)
h. Didactics: active and corporate formats stimulate learning of ethical decision-making better
i. Didactics: open discussions and deliberation are useful for addressing QRPs

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j. Didactics: approaches can differ (lectures, panels, cases) and be used in combination (but poor evidence on effects)
k. Didactics: Research faculty of the institution should participate in instruction in responsible conduct of research in ways that allow them to serve as effective role models for their trainees, fellows, and scholars (Stanford university, various resources)

Target audience

a. Target audiences: undergraduate/bachelor students (Stanford university, various resources, SOPs4RI focus groups)
b. Target audiences: graduate/master students (Stanford university, various resources, SOPs4RI focus groups)
c. Target audience: doctoral/PhD students (Stanford university, various resources, SOPs4RI focus groups)
d. Target audience: postdocs (Stanford university, various resources, SOPs4RI focus groups)
e. Target audience: senior researchers (SOPs4RI focus groups)
f. Target audience: supervisors and team leaders (SOPs4RI focus groups)
g. Target audience: peer reviewers (SOPs4RI focus groups)
h. Target audience: research support staff (SOPs4RI focus groups)
i. Target audience: policy makers, rectors, deans, directors (SOPs4RI focus groups)
j. Target audiences: The Office of Research Integrity's (ORI) budget supports training for Research Integrity Officers (RIOs) (Fostering Integrity in Research)
k. Facilitate training for editors, reviewers, and authors. (Fostering Integrity in Research)

Context

a. Context: Responsible conduct of research is an essential component of research training. Therefore, instruction in responsible conduct of research is an integral part of all research training programs, and its evaluation will impact funding decisions (Stanford university, various resources)
b. Context: Ideally, RCR education should be incorporated into the socialization and training students experience on the job, whether in the laboratory or in the myriad other locations where researchers do their work (Fostering Integrity in Research)
c. Context: RCR training is most effective when it is one element in a comprehensive approach to improve an institution's system of research(Fostering Integrity in Research)
d. Context: RCR training should happen within faculties/doctoral schools/departments/research groups (SOPs4RI focus groups)
e. Context: RCR training should be provided in topic specific courses (e.g. data management, how to be a good leader, research methodology, etc.) (SOPs4RI focus groups)
f. Context: Having experienced specialized training, such as ORI's RIO "boot camp" seminars, was associated with greater knowledge (Fostering Integrity in Research)

Incentives

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a. Incentives: make trainings attractive (SOPs4RI focus groups)
    a. Do not use normative terms such as 'research integrity' in the training title (SOPs4RI focus groups)
    b. Make the training relevant for real life by focusing on daily practice (SOPs4RI focus groups)
b. Incentives: integrate RI trainings into existing courses (SOPs4RI focus groups)
c. Incentives: integrate RI trainings in reward systems (e.g. annual review, funding applications, etc.) (SOPs4RI focus groups)
d. Incentives: make trainings compulsory (SOPs4RI focus groups)
e. Incentives: applications for institutional research training grants lacking a plan for instruction in responsible conduct of research be returned without review (Stanford university, various resources)
f. Incentives: Instruction in responsible conduct of research must be carefully evaluated in all grant applications for which it is a required component (Stanford university, various resources)

Training and teachers

a. Training frequency: every few years (SOPs4RI focus groups)
b. Teachers: researchers with disciplinary-specific experience (SOPs4RI focus groups)
c. Teachers: RI committee members (SOPs4RI focus groups)
d. Best practice: Rotation of training faculty as course directors, instructors, and/or discussion leaders may be a useful way to achieve the ideal of full faculty participation in formal responsible conduct of research courses over a period of time (Stanford university, various resources)
e. Best practice: Instruction should involve substantive contact hours between the trainees/fellows/scholars/participants and the participating faculty. Acceptable programs generally involve at least eight contact hours. A semester-long series of seminars/programs may be more effective than a single seminar or one-day workshop (Stanford university, various resources)

Implementation

a. Implementation factors: supervision (SOPs4RI focus groups)
b. Implementation factors: research environment (SOPs4RI focus groups)
c. Implementation factors: reward and incentive structures
d. Implementation factors: individual differences between trainees (SOPs4RI focus groups)
e. Implementation factors: balance between trust and oversight (SOPs4RI focus groups)

1c. training of RI personnel & teachers

a. Target group: trainers of RI
b. Target group: RIOs and RI committee members
c. Target group: Confidential counselors

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d. Target group: RI advisors
e. Target group: ombudspeople
f. Target group: administrators involved in RI policy
g. Context: within institutions
h. Context: If institutions are not able to train themselves, they should make sure that their staff is trained by some organization – if needed, they should join national or European organizations that can provide training (e.g. ENRIO)
i. Objective/approach: Train-the-trainer trainings should focus not only on RI content, but also on mentoring skills, pedagogical skills, didactical skills.
j. Objective/approach: RIO/RI committee member trainings should focus on the tasks RIOs/RI committee members are involved in (i.e. process of investigating allegations); materials developed by ORI can be used here.
k. Objective/approach: Trainings for ombudspeople/confidential counsellors/RI advisors should focus not only on content, but also facilitation, mediation and interpersonal skills
l. Objective/approach: Trainings should also aim at networking RI personnel & trainers so they can learn from each other and build a support system
m. Methods: Trainings should preferably contain hands-on approaches: role-play, live discussions, solving cases, etc.
n. Format: Trainings face-to-face might be more appropriate here
o. Format: Online trainings may be used to supplement face-to-face trainings
p. Format: Intervision groups could be helpful for trainings aimed at more experienced trainees, so they can learn from each other.
q. Format: Intervision groups are helpful for the training of RI committee members – between universities to discuss cases of misconduct and learn from each other (SOPs4RI focus groups)
r. Format: Less experienced trainees should be exposed to cases & examples of how they were dealt with so as to prepare them for their work.
s. Other: More training programs should be established and they should provide publicly available information about the training.
t. Other: More research should be carried out on the trainings that exist and how helpful they are.
u. Other: School science lessons typically feature discussions on hypothesis testing and the scientific method, how data can be interpreted in different ways and how scientific knowledge is tentative, subjective and open to challenge. (Rising to the challenge as US states turn the screw on science education)
v. Draft a lab manual to introduce trainees to the PI's philosophy for research and work-life balance. (The key to a happy lab life is in the manual)

1d. RI counselling and advice

a. It is important that there is an approachable person that researchers can consult with when they have questions about their day-to-day work, i.e. not only research misconduct issues. (SOPs4RI focus groups)

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b. When consulting with a counsellor due to research misconduct issues, it would be good if the counsellor has some power to take action if needed (SOPs4RI focus groups)
c. Advice can take many forms, which serve different needs, such as: (SOPs4RI focus groups)
    a. Information provided online or in a brochure/etc that is easy to understand (SOPs4RI focus groups)
    b. Privacy officer that is available to consult with on issues (SOPs4RI focus groups)
    c. Research ethics committee which provides advice upon ethics review (SOPs4RI focus groups)
d. Research institutions should provide researchers with contact persons for advice on specialized/domain specific RI issues (i.e. privacy officer for data related issues, research ethics committee members for ethics related issues, legal officers for legal questions, etc.)
e. Research institutions should provide researchers with contact persons for general counselling on RI issues & research misconduct queries. This should be a trained counsellor. This person's name and contact details should be published on the institutional website, and it should be made clear what researchers can and cannot expect from this contact person. This person could also be the first contact point for any researcher who is considering to file an allegation of misconduct.
f. Research institutions should ensure that there are people who are suitable in providing low-threshold counselling and advice about day-to-day RI issues at every faculty/department. These people do not have to have undergone official counsellor training, but should be knowledgeable about and experienced with RI issues. This person's name and contact details should be made available to all staff at the faculty/department. This person could be someone internal (working at the faculty/department) or external.
g. Research institutions should ensure that their researchers have access to information about common RI issues that they could face (e.g. authorship issues, conflicts of interest, etc.) either on their websites, brochures, introduction packages for new employees, or on another medium which researchers can easily access

2. RESPONSIBLE SUPERVISION AND MENTORING

2a. PhD guidelines

a. **Institutions** should communicate to PhD students about what is expected of them, including the standard of work required for a PhD degree
Effective PhD supervision
b. Institutions should provide PhD students with information on what they can expect from their institution and their supervisors/mentors, as well as what options are available to them in the case that their expectations are not being met.

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c. Institutions should require students to ensure that they keep a record of agreements made between their supervisors and themselves.
Effective PhD supervision
d. Institutions should ensure that PhD students have the opportunity to provide feedback to their supervisors (e.g. through integrating this into their annual review meetings, etc.)
e. **PhD students** should respect the authority and wisdom of senior researchers, supervisors and others working with them, but also provide constructive feedback to their seniors.
The SA Medical Research CounsilGuideines on RI
    a. Bring back broad critical thinking that came to be eased out of the doctorate, squeezing academic enquiry into narrow disciplines.
    b. (How philosophy was squeezed out of the PhD , M. Stocker)
f. PhD students should recognize their responsibility to conduct research of high ethical standards
g. PhD students should be aware of the existing rules, norms and the organizations' code of conduct
h. PhD students should ask for guidance to comply with policies and procedures
i. PhD students should participate in all necessary and available trainings to foster responsible good practices
j. PhD students are responsible for the responsible management of data
k. PhD students should ask for help if needed
l. PhD students should know the contacts of the institutes' ombudspeople
m. PhD students should inform his/her supervisor or supervisory committee in case of problems or challenges

2b. supervision requirements & guidelines

Institutions

a. **Institutions** should clearly define and communicate the roles of supervisors and mentors
Effective PhD supervision
b. Institutions should ensure that supervisors are sufficiently qualified in the specific research field that the supervisee is conducting their research in.
Effective PhD supervision
c. Institutions should ensure that supervisors are sufficiently qualified in the specific research field that the supervisee is conducting their research in.
Effective PhD supervision
d. Institutions should ensure that there is a clear policy about supervision at the level of the institution or department/faculty.
Effective PhD supervision
e. Institutions should provide training for supervisors and mentors
Effective PhD supervision
f. Institutions should have measures in place to ensure that time pressures/interruptions imposed by the institution do not harm the quality of supervision provided.
Effective PhD supervision

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g. Institutions should require supervisors to ensure that they keep a record of agreements made between their supervisees and themselves.
Effective PhD supervision
h. Institutions should ensure that supervisors and supervisees formalize agreements about their supervision in written records.
Effective PhD supervision
i. Institutions should require and support supervisors in being familiar with all administrative and procedural requirements of the PhD process.
Effective PhD supervision
j. Institutions should require and facilitate supervisors to provide constructive feedback to their supervisees
Effective PhD supervision
k. Institutions should ensure that only motivated and qualified people are appointed as mentors.
Effective PhD supervision
l. Institutions should ensure that mentors within each faculty/department have mentors/supervisors/coordinators that they can consult with about mentorship.
Effective PhD supervision
m. Institutions should clearly communicate the responsibilities of mentors:
    a. Be aware of all PhD requirements
    b. Ensure that mentees are aware of the requirements
    c. Provide personal support and guidance to the mentee
    d. Identify when it is necessary to refer the mentee for support to other personnel (e.g. for psycho-social support), and be able to identify who to refer them to and how.
    e. Effective PhD supervision
n. Institutions should identify and engage in programs that support good supervision and mentoring (e.g. providing mentorship seminars; continued support for mentorship training; supporting research on mentorship, provide rewards for mentoring, etc.)
Effective PhD supervision
o. Skills in mentoring should be made a condition for hiring faculty members. Mentoring success should also be included as a criterion for tenure and promotion.
    a. (Include mentoring skills in hiring and promotion criteria, S.B. Oppenheimer)
p. Just like research and teaching, mentoring philosophy and practice cannot be learnt in standalone workshops. It must be continually refined and improved through feedback and institutional support.
    a. (Mentorship training curbs academic abuse, S.E. Liao)
q. Written lab agreements on best practices must be made obligatory, to help improve mentoring of students and trainees
    a. (Written lab agreements improve mentoring, J. Gruber et al.)
r. Meetings between students and superviisors should happen at least twice every month. Supervisors should ask students about their projects, what they are proud of, what they have found more difficult than anticipated, and what roadblocks are in their way. They shoul

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enquire about how they want to develop as scientists, what other types of mentor they would like to connect with and what they do when they are not in the lab.
    a. (PhD supervisors: invest more time, D.A. McDonald)

s. Train principal investigators in management and leadership. A supervisor has mentoring responsibilities beyond academic performance, including the student's well-being.
    a. PhD supervisors: be better mentors, D. Mehta & K. Vavitsas

Supervisors

a. **Supervisors/mentors** should acknowledge the accomplishments of their mentees/supervisees
ORI 5 qualities of good mentors
b. Aspects of mentoring that are more practical and can be encouraged include: a level of availability; attention to the framing of a new project; methods by which lab members can help to maintain objectivity by checking each other's data; a balance between giving advice and nurturing independent-mindedness; and support for trainees gaining experience in peer review and in writing grant applications, without turning such experience-gathering into exploitation of labour.
    a. (Great mentoring is key for the next generation of scientists, Editorial)
c. A holistic approach should be followed, taking into account the pressures on women in a traditional culture and encouraging career–life balance through planning and coordination. Such an approach should help develop scientists' skills in grant writing, leadership, ethics, research quality and time management.
    a. (Health research: Mentoring female scientists in Africa , R.G.F. Leke, S.K. Nolna)
d. Supervisors/mentors should challenge mentees/supervisees to develop skills to advance their careers
ORI 5 qualities of good mentors
e. Supervisors/mentors should establish open and responsive communication with mentees/supervisees which promotes research integrity and discourages QRPs
ORI 5 qualities of good mentors
f. Supervisees should establish high standards of the honest reporting of data
    a. ORI 5 qualities of good mentors
g. Supervisors are responsible for providing guidance to researchers in the entire research process starting from the formulation of research questions to finalizing their thesis.
Effective PhD supervision
h. Supervisors should help in the interpretation of the data, if needed
https://openaccess.leidenuniv.nl/bitstream/handle/1887/38561/ASC-075287668-2854-01.pdf?sequence=1
i. Supervisors should monitor supervisees' research practices
http://www.provost.pitt.edu/documents/GUIDELINES%20FOR%20ETHICAL%20PRACTICES%20IN%20RESEARCH-FINALrevised2-March%202011.pdf

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j. Supervisors should recognize their responsibility in providing close supervision and mentoring
k. Supervisors should encourage supervisees to publish their work
l. Supervisors is co-responsible for the quality of the supervisee's research plan
m. Supervisors should set up, jointly with the supervised, periodic meeting
n. Supervisors should be available to discuss any problems concerning the supervised' research, also outside from the already set up meetings
o. Supervisors should make available for their supervised the institutions' code of conduct
p. Supervisors should be responsible of creating an environment of honesty, fairness and open dialogue
q. Supervisors should provide information about how the data has to be managed and stored
r. Supervisors should provide access to all available educational resources, if needed
s. Supervisors should help supervisees in becoming aware of all possible RI issues
t. Supervisors should set high standards for honest reporting of data, regardless of the data are supporting or not the desired outcomes
u. Supervisors should assist supervisees in understanding and adhering to responsible research practices
v. Supervisors should also teach responsible conduct explicitly while supervision research and act as exemplars
w. Supervisors should expose their supervisees to the importance of RI as fundamental concept of doing good research as early as possible
x. Supervisors should discuss openly and fairly with supervisees conflict of interest and authorship issues
y. Supervisors should consider as much as possible cultural diversities to have an appropriate communication style
z. Supervisors should consider as much as possible gender and disabilities to have a different communication style
aa. Supervisors should socialize trainee into becoming a researcher

2c. Building and leading an effective team

Institutions

a. **Institutions** should communicate to team leaders that they are responsible for the research projects of their team
   Guidelines for ethical practices in research
b. Institutions should develop clear policies and procedures on collecting, maintaining and communicating data within the research group/team.
   Guidelines for ethical practices in research

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c. Research institutions should ensure that team leaders have research groups that are of an adequate size to be effectively managed.
Guidelines for ethical practices in research
d. Institutions should have measures in place to prevent the abuse of power and exploitation of dependent relationships, both at the leadership level and the individual level.
DFG Code of conduct
e. Institutions and team leaders should promote high ethical standards and professionalism.
UKRIO code of practice
f. Institutions should provide clear guidance to team leaders on how to manage their teams,as well as set out clear lines of accountability.
UKRIO code of practice
g. Institutions should provide team leaders with the resources necessary to promote responsible research practice among teams
UKRIO self-assesment tool

Team leaders

a. **Team leaders** should demonstrate respect for all team members.
ORI 5 qualities of good mentors
b. Team leaders should acknowledge the accomplishments of team members.
ORI 5 qualities of good mentors
c. Team leaders should challenge team members to develop skills to advance their careers
ORI 5 qualities of good mentors
d. Team leaders should establish high standards of the honest reporting of data
ORI 5 qualities of good mentors
e. Team leaders should regularly check the details of experimental procedures and the validity of data/observatiosn reported by team members, including periodic reviews of primary data in addition to summary tables, graphs and oral reports prepared by team members.
Guidelines for ethical practices in research
f. Research leaders should ensure that all team members understand their roles, rights and duties.
DFG Code of conduct
g. Team leaders should provide career development support for team members.
DFG Code of conduct
h. Team leaders should create an inclusive and open research culture
Netherlands Code of Conduct on RI
i. Lab leaders need strong interpersonal skills to foster a culture of integrity. E.g. by effectively handling difficult conversations, negotiating around shared interests and encouraging members to declare mistakes before they escalate.

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a. (Savvy leadership promotes ethical science , E.A. Luckman)

j. Team leaders should establish common standards of conduct and common goals

Supervisors

a. Supervisors should secure time for team meetings as well as one-person meetings
b. Supervisors should be aware of employees' feeling and needs
c. Supervisors should facilitate communication among team members
d. Supervisors should set ground communication and socializing rules for the team
e. Supervisors should encourage listening and brain storming
f. Supervisors should be able to share responsibilities
g. Supervisors should encourage cooperation among team members
h. Supervisors should be able to define the responsibilities of the members of their teams
i. Supervisors should consider as much as possible cultural diversities within the team to have appropriate communication style
j. Supervisors should consider as much as possible gender and disabilities within the team to have different communication style

3. DEALING WITH BREACHES OF RI

3a. RI bodies in the organization

Not included as this subtopic is already covered by several high quality policy documents.

3b. protection of whistleblowers

Not included as this subtopic is already covered by several high quality policy documents.

3c. protection of those accused of misconduct

a. Anyone accused of research misconduct is presumed innocent until proven otherwise. (ENRIO handbook pg. 16)
b. When a person is accused of research misconduct, the appropriate institutional policies need to be followed allowing for a fair investigation into the allegation.
c. The investigation into the research misconduct must be confidential to protect those accused of research misconduct. Such confidentiality should be maintained provided this does not compromise the investigation of the allegation, health and safety, or the safety of participants in research.
d. Persons accused of research misconduct must be given full details of the allegation in writing and must be afforded a fair process with regards to responding to allegations, asking questions, presenting evidence, calling witnesses (if applicable), and providing responses to information or evidence presented. (ENRIO handbook pg. 15)

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e. Any sanction or action(s) taken should be subject to appeal. In several European countries the conclusion of an investigation cannot be appealed but any imposed sanctions may typically (at least in several countries) be appealed according to law.
f. No persons should suffer any penalty when accused of research misconduct before the allegation is proven. One must be cautious regarding penalties or consequences before the possible appeal process has concluded. (ENRIO handbook pg. 16)
g. The investigating committee or panel may need to strike a balance between disclosure of identities and confidentiality. Such decisions should be made keeping in mind that the primary goal of the investigation (procedure) is to determine the truth of the allegation. (ENRIO handbook pg. 17)
h. Consideration should be given to reasonably and appropriately restoring the reputations of those wrongfully accused. Those accused and found not to have committed research misconduct should be asked about actions to be taken to restore their reputations prior to taking any action of this sort. (pg. 17)
i. Clear guidelines should be in place to help avoid unintended research misconduct or wrongful accusations (suggestion)
j. *Suggestion:* If the investigation finds the allegations were frivolous, vexatious and/or malicious, the RPO may consider recommending that action be taken against the whistleblower, under the organisation's disciplinary process. (UKRIO misconduct in research pg 48)

3d. procedures for investigating allegations

Not included as this subtopic is already covered by several high quality policy documents.

3e. sanctions

Not included as this subtopic is already covered by several high quality policy documents.

3f. other actions (including mobility issues)

Not included as this subtopic is already covered by several high quality policy documents.

4. RESEARCH ETHICS STRUCTURES

4a. set-up and tasks of ethics committees

Not included as this subtopic is already covered by several high quality policy documents.

4b. ethics review procedures

Not included as this subtopic is already covered by several high quality policy documents.

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5. DATA PRACTICES AND MANAGEMENT

5a. guidance and support

Not included as this subtopic is already covered by several high quality policy documents.

5b. secure data storage infrastructure

Not included as this subtopic is already covered by several high quality policy documents.

5c. FAIR principles

Not included as this subtopic is already covered by several high quality policy documents.

6. DECLARATION OF COMPETING INTERESTS

6a. in peer review

Not included as this subtopic is already covered by several high quality policy documents.

6b. in the conduct of research

Not included as this subtopic is already covered by several high quality policy documents.

6c. in appointments and promotions

a. Staff members that have illicit interests or close relationships with candidates should recuse themselves and abstain from participating in the recruitment process.
b. Members of evaluation committees charged with selecting candidates for scientist–researcher positions should sign a prior declaration of absence of conflicts of interest of a scientific or technical nature.
c. Scientific–technical conflicts of interest are sufficient reason for recusal from participating in the body responsible for selecting candidates. For instance serving as advisor or co-advisor for a candidate's PhD thesis within a period of up to 10 years prior to the selection process, co-authorship with a candidate on a significant number of scientific publications, patents or other documents.
d. Standardized forms should be used for disclosure of interests.

6d. in research evaluations

Not included as this subtopic is already covered by several high quality policy documents.

6e. in consultancy

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a. Staff members must not perform any action, establish any relationship or enter into any legally-binding agreement in the name of their organization without authorization or prober discussion with the institute involved.

7. RESEARCH ENVIRONMENT

7a. fair procedures for appointments, promotions and numeration

Not included as this subtopic is already covered by several high quality policy documents.

7b. adequate education and skills training

- In the execution of audits: each auditor's (RI trainer's) qualifications should be documented to verify that he/she is a suitable person to properly conduct audits (RI training), e.g. records of education training and business (conducting training) experience.
  JSQA Guideline for GCP Auditing
- Provide or facilitate training courses for researchers, support staff, research leaders and research managers.
  The Netherlands Code of Conduct for RI
- Embed a focus on research integrity firmly in educational activities of higher education institutions.
  The Netherlands Code of Conduct for RI
- Ensure researchers, particularly early career researchers, have a thorough grounding in research ethics and access to information and training throughout their careers.
  The culture of scientific research in the UK
- Support leaders in research by providing appropriate training.
  The culture of scientific research in the UK
- Ensure peer reviewers receive appropriate training and/or guidance and recognition for their work.
  The culture of scientific research in the UK
- More attention should be given in the PhD assessment to soft skills such as management, entrepreneurship and teamwork.
  What's the point of the PhD thesis?, J. Gould

7c. culture building

- Ensure that researchers can work in a safe, inclusive and open environment where they feel responsible and accountable, can share concerns about dilemmas and can discuss errors made without fearing the consequences ('blame-free reporting').
  The Netherlands Code of Conduct for RI

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- Ensure compliance with all relevant statutory regulations, codes of conduct, instructions and protocols.
  The Netherlands Code of Conduct for RI
- Provide clear instructions, protocols and other means to support researchers and to help them understand what constitutes good research practice within their discipline(s) and institution.
  The Netherlands Code of Conduct for RI
- Provide an open, safe and inclusive research culture in which researchers: a. discuss the standards for good research practices, b. hold each other accountable for compliance with the standards.
  The Netherlands Code of Conduct for RI
- Ensure transparent and fair procedures for appointments, promotions and remuneration
  The culture of scientific research in the UK
- Support early career researchers to plan their future careers and expand their skills and experience outside of the research environment, and tackle negative attitudes towards those leaving academia.
  The culture of scientific research in the UK
- Cultivate an environment in which ethics is seen as a positive and integral part of performing research.
  The culture of scientific research in the UK
- Consider further the role of publishers in tackling ethical issues in publishing such as those related to authorship and retractions, and in promoting openness and data sharing among scientists.
  The culture of scientific research in the UK
- RPOs must provide the necessary feedback to PhD candidates and early career researchers, in order to be able to assess their career options and consider opportunities to widen your experience. (presumed recommendation)
  Is the reproducibility crisis fuelling poor mental health in science?, J.C. Clements
- Apply direct training on how to effectively recognize and produce transparent and reproducible research (from experimental design through to publication) to help alleviate researchers' stress and improve their mental well-being.
  Is the reproducibility crisis fuelling poor mental health in science?, J.C. Clements
- RPOs should find ways, in order to make clear the importance of publishing negative and null results would also be of benefit. (presumed recommendation)
  Is the reproducibility crisis fuelling poor mental health in science?, J.C. Clements
- Avoid monetary incentives since they create a culture in which research becomes a means to make money and risks shifting the focus of researchers away from the best way to pursue and expand on experiments, towards a focus aiming at getting the results published.
  Don't pay prizes for published science, Editorial

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- Junior researchers should evaluate case studies derived from flawed real research, or use interdisciplinary detective games to find logical fallacies in the literature. Above all, students must be shown the scientific process as it is — with its limitations and potential pitfalls as well as its fun side, such as serendipitous discoveries and hilarious blunders.
  Train PhD students to be thinkers not just specialists, G. Bosch
- Research integrity is often taken to mean misconduct and its prevention. But the integrity of research enfolds much broader dimensions that represent the health — technical, ethical, social and psychological — of research activity. This year's report, Fostering Integrity in Research, recommends that the RIAB (Research Integrity Advisory Board) should be independent of government or other institutions, and funded by subscriptions from stakeholder bodies such as universities and funders.
  Research health needs a dedicated group, Editorial
- Techniques developed for the manufacturing industry can help you to visualize where things have become stuck. Think of a lab as manufacturing science.
  How lab heads can learn to lead, R. Kwok
- Provide courses on scientific leadership and management skills. E.g., the University of California, San Francisco, offers a 16-hour course on scientific leadership and management skills that targets people hoping to lead research groups. (presumed recommendation)
  How lab heads can learn to lead, R. Kwok
- The Technical University Berlin, the Humboldt University of Berlin and the Free University Berlin have joined forces to offer their female researchers a programme named ProFiL, which combines mentoring, seminars and training sessions.
  How lab heads can learn to lead, R. Kwok
- Initiatives to foster RI must pay sufficient attention to the research health of research groups and the people who lead them. This includes technical robustness of lab practices, assurance of ethical integrity and the psychological health and well-being of group members. (presumed recommendation)
  Integrity starts with the health of research groups, Editorial
- PIs must be given the tools to assess the health of the researchers working in a group. E.g. there are survey-based tools that can assess the health of an organization's research culture (such as that at go.nature.com/2p3fjed) need to be utilised more often. Institutions should pursue such support and oversight, to help PIs assess their groups and to allow independent checks. (presumed recommendation)
  Integrity starts with the health of research groups, Editorial
- Research culture and policies but must also set standards for avoiding the mistreatment of people. E.G. the project, ADVANCEGeo, equips bystanders to respond to and prevent harassment in the field, lab, office and at conferences, and advocates for inclusion of the subject in courses on ethical research conduct. (presumed recommendation)
  Harassment should count as scientific misconduct, E. Marín-Spiotta

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- Students might end up spending their time focusing only on what papers they can produce, then staple them together with a summary and they're done — adding to the sense that the whole scientific enterprise is a paper factory rather than an exploration. PhD theses must be something more that collating publications of the PhD candidate. (presumed recommendation) What's the point of the PhD thesis?, J. Gould
- To better reflect the team-based nature of science a joint thesis must be established, following the approach that has been used in arts and humanities graduate education in the past. What's the point of the PhD thesis?, J. Gould

7d. managing competition & publication pressure

a. Ensure that the track record of researchers is assessed broadly, without undue reliance on journal impact factors. The culture of scientific research in the UK
b. Departments would instead be required to submit only a certain number of outputs overall: some principal investigators might report more than average; some might even report none. A good institute head would balance their virtues on the basis of the long-term character of their research. UK research assessment should boost support for principal investigators, Editorial
c. Institutions should act directly to mitigate pressures on principal investigators, for example by supporting staff for data-management planning and sharing, crafting grant applications and administrative tasks. UK research assessment should boost support for principal investigators, Editorial
d. Older investigators should be encouraged to move into alternative stages of their career — working in teaching, mentoring and science advocacy — that don't require research funds. This could help a shift of resources to the younger people. Young, talented and fed-up: scientists tell their stories, K. Powell

7e. conflict management

Not included as this subtopic is already covered by several high quality policy documents.

7f. diversity issues

a. Sign up to the principles of the Athena SWAN Charter and adopt other employment practices that support diversity and inclusion. The culture of scientific research in the UK
b. Organize open discussions to create a supportive and safe space for people to express their thoughts and feelings, speak of the racism they experience inside science as well as outside. Black and minority-ethnic participants said they found the discussions cathartic. White participants said it helped them to better empathize with colleagues facing racism. Make space for scientists from minority groups to share their experiences, G.G. Pacheco

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c. In some countries, the 'feedback sandwich' is common: start with praise, suggest improvements and end with encouragement. Students from countries where this format is less common might think that because comments were mostly positive, the suggestions are optional and can be ignored. To avoid such mishaps, students could write an e-mail after each meeting summarizing the feedback and next steps so that the supervisor can correct their interpretation if needed.
    a. Many resources are available for international students and postdocs and their supervisors.
    b. Other resources: Western Guide to Mentoring Graduate Students Across Cultures (University of Western Ontario Teaching Support Centre, 2009)
    c. Cross Cultural Supervision Project website at Macquarie University in Sydney, Australia website at Macquarie University in Sydney, Australia
    d. The Culture Map (PublicAffairs, 2014) and blog posts by Erin Meyer
    e. Cheat Sheet to 10 Cultural Codes From Around the World e-book by Andy Molinsky
    f. When a Chinese PhD Student Meets a German Supervisor: Tips for PhD Beginners (University of Konstanz, 2016)
    g. Managing Cultural Diversity in Technical Professions by Lionel Laroche (Butterworth-Heinemann, 2002)
    h. How to fit in when you join a lab abroad, R. Kwok
d. Improve the way hiring and promotion interviews take place to remove physical barriers for people with mental or physical disabilities; introduce specific training on unconscious bias, focusing on managers who are part of interview boards. What does it take to make an institution more diverse?, V. Gewin
e. The Technion set up coaching programmes for prospective students, workshops in core courses run by high-achieving Arabic-speaking students, personal tutoring in social engagement, and professional guidance on self-management. Arab students thrive in Israeli's Technion, H. Haick et al.

7g. supporting a responsible research process (transparency, quality assurance, requirements)

Not included as this subtopic is already covered by several high quality policy documents.

8. PUBLICATION AND COMMUNICATION

8a. publication statement

Not included as this subtopic is already covered by several high quality policy documents.

8b. authorship

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Not included as this subtopic is already covered by several high quality policy documents.

8c. open science

Note: The topic of open science is well developed in policy documents and in university policies. Nevertheless, we decided that it was relevant to include it given the fast advances in the field and given its presence on the research policy scene.

a. RPOs should develop and implement an open science policy.
b. RPOs open science policy should be a detailed document on how the organization is following the open science principles and what the responsibilities of researchers are.
c. RPOs open science policy should contain the information related to the openness and availability of scholarly publications (open publication), research data (open data) and data management, methodology, use of open source technology and analysis.
d. RPOs open science policy should contain information of public and trusted repositories and obligation for depositing research articles in organizational, national or disciplinary repositories.
e. RPOs open science policy should be linked to organizational data management policy.
f. RPOs open science policy, together with data management policy, should be revised and updated regularly, in line with the latest knowledge and requirements from open science field.
g. The adopted policy on open science should be publicly available and easily accessible, together with other organizational policies.
h. To monitor the implementation of open science and data management policies, RPOs should establish a committee or other organizational body that will regularly check the researchers' compliance with the policies and deal with possible issues.
i. RPO should ensure that researchers have undergone adequate training on open science.
    I. The training on open science should be a part of the PhD studies and if needed, conducted regularly also for senior researchers or at the undergraduate level as a part of research integrity training.
    II. The training should cover but be not limited to the following areas of open science: open access (definitions, initiatives, routes – green and gold route, use and reuse of open access material), open data (definitions, standards, use and reuse of open data, big data, journals, open government data), open reproducible research (open lab books, open science workflows, open-source, reproducibility guidelines), open science evaluation (metrics and impact, peer review), open science guidelines, open science policies (funders policies, governmental policies, institutional policies, open access policies, open data policies), open science tools (open repositories, open services),
    III. The training should also include: education on FAIR principles (making data findable, accessible, interoperable and reusable), exceptions of open science related to legal and ethical considerations, education on criteria for selection of trustworthy repositories.
j. RPOS should ensure that all research work is archived in the organizational, national or other public repository.

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k. RPOs should establish a body within the organization and ensure human resources, who will accept researchers publications and making them available in organizational, national or other repository.
    I. This work can also be done by information specialists, in which case RPOs should ensure enough human resources for the work to be done in a proper and timely manner.
l. RPOs should ensure that people responsible for training and dealing with researchers' publications have skills and knowledge to advise on open science and data management requirements.
m. RPOs should encourage researchers to publish their research work in open access journals and if possible and needed (i.e. if resources are not secured by funder) ensure the financial support for researchers who want to publish their work in such journals.
n. RPOs should provide incentives for researchers who publish their work following the principles of open science. This may include taking into account open publications for promotions and tenures.
o. RPOs should encourage researchers to publish preprints of their work to enable free and open access to research results before peer review process, as well as to enable the immediate discovery and discussion of research results.
p. RPOs should encourage researchers to register their research plans or research protocols in available public services.

8d. use of reporting guidelines

Not included as this subtopic is already covered by several high quality policy documents.

8e. peer review

Not included as this subtopic is already covered by several high quality policy documents.

8f. predatory publishing

a. RPOs should provide education for researchers on predatory (fake) publishing and guidance to avoid such journals.
    I. The guidance on predatory (fake) publishing can consist of guidelines, checklists or standard operating procedures that will be available to researchers and with which they can easily check the characteristics and quality of journals before deciding on submission.
b. RPOs should inform and educate researchers on helpful tools which can help researchers in assessing the quality of journals and potential predatory characteristics (e.g. Think. Check. Submit)
c. RPOs should provide on their web pages a link to the current list of predatory journals from the field of interest, and make it available to researchers together with other guidance documents.

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I. Examples of such lists are available at the web pages of Yale University Library (https://guides.library.yale.edu/c.php?g=296124&p=1973764) or Stop Predatory Publishing site (https://predatoryjournals.com/journals/).

d. Since predatory journals may sometimes put on their pages' the information that the journal or publisher is the member of a recognized organization that follows good publication practices, or that the journal is indexed in one of the well-established databases, RPOs should educate researchers that it is important to check this information from sources other than journal web pages.
e. RPOs should provide researchers with information about possible actions to be taken if the article was submitted to the predatory journal. These actions may include contacting the journal to insist on suspending the publication, withdrawing the article if it is already published or taking legal actions against the journal.

8g. communicating with the public

Not included as this subtopic is already covered by several high quality policy documents.

9. COLLABORATIVE RESEARCH AMONG RPOS

The below SORS **are applicable to all the 3 subtopics related to collaborative research: -among RPOs inside/outside Europe;- with countries with different R&D infrastructure; between public and private RPOs.**

a. All parties involved should comply with standards of good research practices
b. All parties should provide their staff with information about good research practices and how to promote RI (inspired by UKRIO checklist for researchers) all parties should state any possible conflict of interest at any level (inspired by Knowledge transfer Ireland)
c. All parties should agree on the objective(s) of the project
d. All parties should agree on the project agenda (inspired by Knowledge transfer Ireland)
e. All parties should agree on a collaboration agreement (inspired by Knowledge transfer Ireland)
f. All parties should define beforehand a fair division of responsibilities and tasks (no source)
g. All parties should agree about the definition of research misconduct. Strict definition or honest mistake.
h. Rules and procedures for handling investigations should implement accordingly
i. All parties involved should be able to share all documents and data in a dedicated platform (no source)
j. All parties involved should agree on a well defined publication/dissemination plan
k. All parties should agree on a data sharing plan, material transfer plan, facility use agreement (inspired by UKRIO checklist for researchers (inspired by ORI)
l. All parties should agree on a data sharing plan, material transfer plan, facility use agreement (inspired by UKRIO checklist for researchers (inspired by ORI)
m. All parties should agree on a list of specific material (lab material, equipment etc.) that can be shared among partners (inspired by Knowledge transfer Ireland)

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n. All parties should agree on the copyright, intellectual property, patent, licence, etc. of possible outcomes (inspired by Knowledge transfer Ireland)
o. All parties should state any possible conflict of interest at any level (inspired by Knowledge transfer Ireland)
p. all parties should ensure confidentiality regarding outcomes, data sets, etc, (inspired by Knowledge transfer Ireland)
q. all parties involved should appoint one or two internal ombudspeople (no source)
r. an internal system of peer review should be implemented (no source)
s. all parties involved should comply with ethical requirements if needed
t. all parties involved should have access to the financial reports, etc. (inspired by Knowledge transfer Ireland)
u. all researchers involved should have access to all documents concerning the project (DMP, publication plan, financials reports, etc.) (inspired by Knowledge transfer Ireland)
v. all researchers should participate in periodic meetings (no source)
w. All parties involved should guarantee to all researchers all requirements of health and safety. Moreover, all parties involved should comply with best practices from the environmental point of view (no source)

9a. among RPOs inside/outside the EU

a. parties and researchers should pay particular attention where work will be carried out in another country to the additional legal and ethical requirements and other guidelines that may apply (inspired by Knowledge transfer Ireland)

9b. with countries with different R&D infrastructures

a. Parties from high-income countries should contribute to strengthening RI culture
b. Parties from high-income countries should help in educating researchers of institutions in low/middle-income countries when this is needed
c. All parties should guarantee independence during the research process to other partners (no source)
d. Parties from high-income countries should disclose conflicts of interest (if any) when they are helping in implement R&D infrastructure and in building capacities (inspired by CIOMS guideline; (inspired by Knowledge transfer Ireland)
e. Parties from high-income countries and sponsors should disclose how the research can contribute to local capacities (no source)
f. Equity in the decision making should be guaranteed (no source)
g. Local or researchers from low\middle income countries should be involved in any part of the process
h. Data and outcomes should be available to all parties
i. If needed, parties from high-income countries should help in developing a local ethics committee

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j. Both sides should have control over or in say how the budget is allocated and used (inspired by Knowledge transfer Ireland)
k. Proposals and other arrangements should be drafted jointly (inspired by Knowledge transfer Ireland)

9c. between public and private RPOs

a. Public parties should disclose any possible conflict of interest with other competing private RPOs
b. Academic right to publish should be guaranteed as much as possible
c. all relative financial contributions should be well defined a priori
d. all pre-existing knowledge about the topic of the project should be disclosed
e. early termination of the collaboration should be communicated in advance (….days)
f. all parties should agree on the development of a commercial plan for possible outcomes
g. confidentiality should be guaranteed in accordance with the private parties
h. all parties should have access to all phases of the project and to all data sets

Sets of Recommendations for the RFOs - final version

1. DEALING WITH BREACHES OF RI

1a. RI bodies in the organization

Not included as this subtopic is already covered by several high quality policy documents.

1b. procedures for breaches of research integrity by funded researchers

a) All parties involved should follow appropriate guidelines on good research practice. (Wellcome Trust, Research Misconduct)
b) Funded organisations need to have procedures in place to allow a fair investigation of alleged research misconduct
c) It is the funded organisation's responsibility to investigate allegations of research misconduct of funded researchers
d) The RFO itself can undertake an investigation when its reputation is at risk or the RFO is dissatisfied with the investigation undertaken by the funded organization. (Handling of allegations by Wellcome)
e) In case of a potential research misconduct by a funded researcher being brought forward by an informant at the RPO:
    i. The RFO should be informed, in confidence, about any allegations of research misconduct made against employees at the funded organisation. Information on the category of research misconduct and the investigation process must be provided to

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the RFO. This should be done as soon as possible, and in any event no later than the point at which a decision is made to conduct an investigation, preliminary or otherwise. If there is a full investigation, the host organisation must tell the RFO the name of the person accused, in confidence.

ii. The RFO will be informed of the outcome of the investigation as soon as it is known and the RFO will be provided with the final investigation report.

f) In case of a potential research misconduct by a funded researcher being brought forward by an informant at the RFO:

I. The allegation of research misconduct will be discussed with the informant

II. A designated individual at the RPO (e.g RIO) will be contacted, in confidence, to take a suitable line of action for handling the allegation.

III. The RFO will not form an opinion on any allegation until an investigation has been completed and will only provide information to there staff or external advisors as necessary.

IV. An informant may wish to remain anonymous, this will be respected unless:

i. there are overriding legal requirements that the RFO reveal the identity of the informant

ii. it is impossible to maintain anonymity to conduct an investigation

iii. the informant subsequently agrees to relinquish anonymity.

iv. The informant will be notified of any proposed change to their anonymity.

1c. by review committee members and 1d. by reviewers

a) All reviewers and review committee members invited by the RFO should follow the guidelines on good research practice and declare any conflicts of interest.

b) The RFOs will clearly state their procedures for research misconduct by reviewers and review committee members and possible sanctions on their website

c) The RFO will clarify what they include in research misconduct:

I. Specifically with regards to potential research misconduct by review members and review committee members, such as intellectual property rights, conflict of interest and malicious review

d) The RFO will take appropriate action when research misconduct by a reviewer or review committee member is reported to them.

I. Appropriate action includes settling of the dispute, conflict management or a full investigation

II. The RFO will establish who will be informed - the researchers from the grant under application? A person at the RPO? Someone else?

e) The allegation process must be fair, confidential, uniform and without detriment. (National policy statement on Ensuring Research Integrity in Ireland)

f) When the case becomes a full investigation, the case should be investigated by a panel of independent experts, preferably established in their fields, in accordance to the practice of concrete breaches of research (e.g. life sciences, mathematical, informational and communicational sciences, arts and humanities, etc.) (National policy statement on Ensuring Research Integrity in Ireland)

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I. An unbiased person outside the RFO should be included in the investigation committee to investigate the research misconduct, increasing the acceptance and credibility amongst all parties involved in the investigation (enrio handbook pg. 9)

g) The procedures of a formal investigation should be divided into stages, offering balanced, fair and confidential treatment of all parties involved: initial evaluation and screening of the complaint/request, investigation and inquiry, formal hearings of all parties (witnesses), providing an assessment/final statement. (ENRIO Handbook)
h) Detailed and confidential records should be maintained on all stages and aspects of the procedure. (National policy statement on Ensuring Research Integrity in Ireland, ENRIO Handbook, OECD Global Science Forum)
i) Any possibility of conflict of interest should be avoided while investigating research misconduct (family, research, institutional CoL should be clearly stated in the beginning of the process). (National policy statement on Ensuring Research Integrity in Ireland)
j) Any formulated conclusions of the investigation should be given in a written description of the procedures followed, description of the parties involved, experts and witnesses, and whether the complaint/request was well-founded or unfounded.
k) The actions and sanctions taken have to be prompt, adequate, taking into consideration existing legal and administrative framework and relevant institutional statues. (National policy statement on Ensuring Research Integrity in Ireland)
l) A possibility of appeal/second opinion should be considered, taking into consideration the existing legal and administrative national framework. (ENRIO Handbook)

1e. by staff members

a) All staff members of the RFO will uphold guidelines on good research practice.
b) The RFO will specify what includes research misconduct by staff members
c) When a staff member suspects research misconduct of another staff member:
    I. Sharing information of proposals or other research documents can take place only when necessary to prevent and/or respond to suspected research misconduct. (COPE, Sharing of Information Among Editors-in-Chief Regarding Possible Misconduct)
    II. Information shared should be restricted to factual content only, avoiding conjecture, supposition, or inference (no indications on wrongdoing). (COPE, Sharing of Information Among Editors-in-Chief Regarding Possible Misconduct)
    III. Alleged research misconduct of staff members should be communicated to a very limited number of partners in a most confidential manner. (COPE, Sharing of Information Among Editors-in-Chief Regarding Possible Misconduct)
    IV. Staff members should be aware of such sharing of information, the procedures and steps should be clearly stated by the RFO. (COPE, Sharing of Information Among Editors-in-Chief Regarding Possible Misconduct)
d) The RFO should have internal rules for the procedure of sharing information, taking into consideration who has to be informed, to whom the breach has to be reported, which actions to take and how to handle research misconduct allegation by internal and external parties
e) The RFO has internal investigation processes in place when breach of research misconduct is reported to the RFO when it concerns staff members

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a. The internal investigation process can be the same as described for reviewers and review committee members

1f. protection of whistleblowers and the accused

a) RFOs should provide a definition of research misconduct that aligns with the EcoC (suggestion)
b) The definition of research misconduct should be in line with international and national guidelines and documents (suggestion)
c) The definition should be visible and understandable for all parties (suggestion)
d) RFOs should establish a procedure for protection of informants/whistleblowers (suggestion)
e) All efforts will be made to protect the persons accused (suggestion)
f) Procedures should be clear to all parties involved, taking into consideration the highest confidentiality at all stages (suggestions)
    a. The RFO must contact the relevant RPO (suggestion)
g) An informant can remain anonymous, unless there are overriding legal requirements (Handling of allegations by Wellcome)
h) All efforts will be made to protect the whistleblower after the investigation had completed (suggestion)

1g. sanctions/other actions

a) Sanctions should be always adequate and proportional (Netherlands Code of Conduct for Research Integrity)
b) Sanctions might include withdrawal of funding, prohibition on submitting applications (for a limited period of time), prohibition on functioning as a peer reviewer or bodies giving advice regarding funding, obligation to pay back funds. (ENRIO Handbook)
c) If an allegations of research misconduct is upheld, the RFO will consider appropriate sanctions (letter of reprimand, removal from grant in question or withdrawal of current funding, restriction from future grant applications, requiring the withdrawal or correction of pending or published abstracts, papers or monographs produced by the research in question) (Wellcome Trust, Sanctions – Research Misconduct)
d) The host organization should in a timely manner and in writing inform the RFO on the investigation (Wellcome Trust, Sanctions – Research Misconduct)
e) CoI sanctions: breaches of CoI policy will lead to suspension or termination of the relevant award/funding (Wellcome, CoI – Sanctions)

2. DECLARATION OF COMPETING INTERESTS

2a. among review committee members

a. After receiving the overview of applications, committee members are required to indicate and sign the declaration of competing interests

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b. In case of a putative competing interests the member has a consultation with the chair (and secretary; or neutral: the responsible person at the RFO) of the committee
c. In case of a competing interest the committee member does not receive the applications in which he/she has a competing interest (included steps: pre-advice, assessment, deliberation of and access to deliberations on the application or prioritization of it, receipt of overview of scores)
d. The chair of the committee ascertains at the start of the meeting that no other competing interest has arisen
e. The chair of the committee could take additional control measures (participation of a neutral observer, increased number of committee members, splitting into sub-committees)
f. All competing interests must be documented in written form and reported to the decision-making body of the RFO

2b. among reviewers

a. A reviewer with a competing interest must report it in written form to the responsible person at the RFO
b. In case of a competing interest the reviewer does not receive the applications in which he/she has a competing interest

2c. among staff members

a. A staff member with a competing interest must report it in written form to his/her superior
b. The superior makes a decision about the staff members' participation in the review process and any control measures to be taken

3. FUNDERS' EXPECTATIONS OF RPOS

3a. Codes of Conduct

a. RFOs should ensure that RPOs clearly describe what they mean by research integrity in a code of conduct.
b. RPOs should develop a policy on research integrity which includes promotion of good research practice, clear procedures for dealing with allegations of research misconduct and a description of the possible sanctions that can be employed in proven cases of misconduct.
c. All these documents must be publicly available
d. The code of conduct should be actively communicated, easily accessible and evaluated/revised regularly
e. The code of conduct should be in accordance with the European Code of Conduct. (*own phrase*)

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f. The code of conduct should include a definition of good research practices, research misconduct and breaches of inacceptable research practices. (*own phrase*)

3b. assessment of researchers

a. RPOs should not use journal-based metrics, such as Journal Impact Factors, as a surrogate measure of the quality of individual research articles, to assess an individual scientist's contributions, or in hiring, promotion, or funding decisions.
b. RPOs should be explicit about the criteria used to reach hiring, tenure, and promotion decisions, clearly highlighting, especially for early-stage investigators, that the scientific content of a paper is much more important than publication metrics or the identity of the journal in which it was published.
c. For the purposes of research assessment, RPOs should consider the value and impact of all research outputs (including datasets and software) in addition to research publications, and consider a broad range of impact measures including qualitative indicators of research impact, such as influence on policy and practice.
d. RPOs committees making decisions about funding, hiring, tenure, or promotion, should make assessments based on scientific content rather than publication metrics.
e. RPOs should assess researchers on responsible practices from conception to delivery, including the development of the research idea, research design, methodology, execution and effective dissemination. (*Hong Kong Principles*)
f. RPOs should value the accurate and transparent reporting of all research, regardless of the results. (*Hong Kong Principles*)
g. RPOs should value the practices of open science (open research) - such as open methods, materials and data. (*Hong Kong Principles*)
h. RPOs should value a broad range of research and scholarship, such as replication, innovation, translation, synthesis, and meta-research. (*Hong Kong Principles*)
i. RPOs should value a range of other contributions to responsible research and scholarly activity, such as peer review for grants and publications, mentoring, outreach, and knowledge exchange. (*Hong Kong Principles*)

3c. education and training for RI

a. RPOs should actively support training in research integrity.
b. RPOs should implement a training strategy which is in line with the organization's research strategy and in synergy with the funders' strategic objectives. (inspired by *UKRI*)
c. The emphasis should be on enhancing the excellence and quality of doctoral training (rather than maximizing student numbers). (inspired by *UKRI*)
d. RPOs should ensure that all people working on research projects are trained in good research practice.
e. RPOs ensure that training in research integrity is mandatory and that it starts at the undergraduate/PhD level and continues throughout a researcher's career.

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f. RPOs are expected to provide excellent standards of supervision, management and mentoring. (inspired by *UKRI*)
g. Supervisors should receive the support and training that they individually need to provide the highest-quality supervisory support to early-career researchers, and be aware of their responsibilities to treat them in a fair, open and non-discriminatory manner. (inspired by *UKRI*)
h. *Early-career researchers* should receive training in the principles of good research conduct in their discipline, and understand how to comply with relevant ethical, legal and professional frameworks. (*inspired by UKRI*)
i. *Early-career researchers* should be provided with training to identify and challenge unintentional bias as appropriate to their studies. (*inspired by UKRI*)
j. *Early-career researchers* should receive training in experimental design and statistics appropriate to their disciplines and in the importance of ensuring research results are robust and reproducible. (*inspired by UKRI*)
k. RPOs should have mechanisms in place to assess and monitor individual student/ *early-career researchers* needs and put in place appropriate development opportunities. The provision of training should be kept as flexible as possible allowing customization to suit the individual needs. (*inspired by UKRI*)
l. RPOs should provide learning and training opportunities to help develop public engagement skills. (*inspired by UKRI*)
m. RPOs should provide in-depth advanced training, as well as developing a broad understanding of their subject area. Students/*Early-career researchers* should also develop an understanding of how their research fits into the broader "research and innovation system" and of practicable routes to maximizing economic, social and/or health impact. (*inspired by UKRI*)
n. RPOS are expected to provide an environment where *early-career researchers* have the opportunity to widen their horizons as part of their training. Experiences outside their home institution like other academic collaborators, in non-academic environments or overseas are encouraged when it fits with the individual and scope of the project. These should be well planned to ensure the *early-career researcher* gains maximum benefit. (*inspired by UKRI*)
o. Supervisors should recognize doctoral study as a wider training opportunity and encourage and support in developing their careers. (inspired by *UKRI*)
p. Career advice should be provided to enable students to choose the most appropriate type of PhD and have the confidence and skills to explore the impact they can have in a wide range of relevant sectors and so manage their careers. (inspired by *UKRI*)
q. RPOs should encourage responsible bodies to establish train-the-trainer courses to introduce knowledge sharing and harmonization and to maintain training standards.

3d. processes for investigating allegations of research misconduct

Not included as this subtopic is already covered by several high quality policy documents.

4. SELECTION & EVALUATION OF PROPOSALS

4a. RI plan

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A. RFOs should document in their processes how assessment panel members are instructed to assess research integrity plans in their framework procedures
B. RFOs should require host institutions to provide research integrity training for researchers working on the funded project (Wellcome trust - good research practices)
C. The RFO should have a specific section in their application forms that is dedicated to RI and that requires the institution or PI to write a research integrity plan where they discuss:
    A. What RI training they will access/provide for their research team and when (needs to be completed within the first year)
    B. How they will ensure responsible research practices such as preregistration, data analysis plans, the use of preprints, the assurance of open science practices, how to deal with responsible authorship guidelines, how to implement and comply with the FAIR principles (Findable, Accessible, Interoperable, Reproducible), how applicant/host institution assures open data/ open access
    C. How early career researchers will be mentored
    D. How the institutional code of conduct is safeguarded in their procedures from the RFO
    E. How an institution put policy in place to foster a responsible research culture
    F. How the institution deals with bullying and (sexual) harassment
    G. How data management plans are constructed and how data is managed
    H. If applicable, how the applicant is safeguarding good laboratory practices
    I. The host institution provide good publication practices by stimulating good authorship practices, responsible communication of research results and fostering open access publications
    J. Have policy in place that takes the institutional code of conduct as the guiding document to foster RI (or European code of conduct?)
    K. How the applicant plans to assure RI in the dissemination and use of the outputs, knowledge and discoveries that the proposal might generate to have as much impact as possible. Researchers should explore ways to do this both within and beyond academic routes.

    L. How the applicant plans to deal with breaches of RI and what supporting policies and processes are in place in the institution to deal with misconduct

4b. methodological requirements

(The recommendations below are - among others - from Wellcome Trust website - but are not official requirements)

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A. Proposals are assessed on the quality of the research methodology. This must be rigorous and well-planned to ensure that results are as robust and unambiguous as possible, and to enable reproducibility/replicability of studies.
B. The RFO should include a methodology section in the proposal that should include, for example (depending on the discipline):
    a. a description how to deal with study (pre)registration before the study is conducted.
    b. the extent to which the applicant and their team have had methodological training or have extensive methodological experience, which should be detailed in this section
    c. If applicable, methodological plans should include how results will be reported and which reporting guidelines are being used.
    d. If applicable, research methods should emphasize how they deal with potential gender differences in their study population
    e. If applicable, researchers must describe how they will access advice and guidance from the clinical research infrastructure in the host institution.
    f. If applicable, applicants must describe how potential methodological biases are addressed in the study.
    g. If applicable, the methods should justify the statistical tests being proposed to determine adequate power, sample and group size
    h. The methods should include a description of how bias in data collection and analysis will be managed.
    i. When using animals, tissues or cells, researchers must describe how they will determine the appropriate sample sizes, controls and replicates in their studies.
    j. Researchers should describe how they plan to maintain accurate records of their methodologies, procedures and the approvals granted during a project. These should be reported clearly in any publications to enable the study to be repeated.
    k. Research records or laboratory notebooks should include clear cross-referencing to electronic data sources (such as data repositories).

C. RPOs should describe their standard procedures for signing off and archiving laboratory records and notebooks.

D. RFOs should have assessment criteria/guidelines in place for the assessment of Data Management plans

4c. plagiarism

a. RFOs should have policies in place about ensuring that submitted proposal do not contain plagiarized material/use original materials
b. RFOs should have text similarity check softwares in place to detect plagiarism in proposals

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c. RFOs have a guideline in place to communicate potential plagiarism cases

4d. diversity issues

a. The RFO is committed to promoting and supporting all types of diversity in the selection of proposals/applicants — including gender, sexual orientation, geographic, thematic (where appropriate), methodological and other underrepresented groups.
b. The RFO is committed to achieving and maintaining a diverse membership of their staff members, review members and committee members, with regard to gender, sexual orientation, geographical region, and research topic or approach.
c. The RFO has regular monitoring in place to examine whether their organisational structures and processes are susceptible to potential diversity issues. If so, the RFO will develop and implement a plan to mitigate any identified diversity issues. It is crucial that the RFO's leadership commits to this plan, sees it through with appropriate encouragement, support and initiatives, throughout the organisation.
d. The RFO will examine crucial areas of potential diversity issues and define measures for countering these. Progress needs to be monitored and, if necessary, measures re-examined and adjusted.
e. The RFO will promote the involvement of members from currently underrepresented groups and from regions with less developed research capacities in the association's activities
f. Recruitment and/or funding processes should be as open and transparent as possible and be genuinely merit-based. This includes measures such as briefing selection committees about bias pitfalls, deciding on clear selection criteria at the outset, letting external observers monitor the selection process and involving external evaluators.
g. The RFO requires submitted research proposals to include a gender and diversity statement regarding a) the researchers in the call and b) when applicable, the researched population.
h. The RFO commits to closely monitor potential bias in language used in recruitment processes and funding calls.
i. The RFO will undertake action towards eliminating the pay gap and monitor progress, examining bias as a contributing factor to pay gap.
j. The RFO will compensate employees for parental leave, making sure the process is bias-free, for example by extending fixed-term positions or calculating the leave administratively as active service, yet exempt from publication expectations.
k. The RFO will monitor precarious contracts and part-time positions for any gender-based differences and correct any inequalities. Universities should examine conditions for part-time positions for professors and their gendered division.
l. The RFO will undertake positive action towards a proper representation of a diverse reflection in all leading positions, making sure that leadership and processes around leadership are free from bias.

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Sources:

Gender (copied from https://www.embassy.science/theme/gender-bias and https://www.leru.org/files/LERU-PPT_Bias-paper_Jadranka_Gvozdanovic_January_19_18.pdf)
Diversity (adapted from https://www.easp.eu/about/sis/?)

5. RESEARCH ETHICS STRUCTURES

5a. research ethics requirements

General

a. The RFO ensures appropriate checks are in place for guarding the national and institutional research ethics requirements of the proposed research
b. When applicable, the RFO requires funded researchers to have in place before the start of the research:
    a. ethical approval in the country where any part of the research will be carried out
        i. When that part of the research falls under national legislation for which the researcher needs to obtain ethical approval
    b. the relevant regulatory and ethical approvals for every site where research will be carried out
        i. A research site is specified as the relevant institution in which the research will be carried out
    c. Appropriate governance mechanisms
c. The RFO requires researchers applying for a grant to include in their proposal:
    a. who will review the ethics of the project
    b. when it will be reviewed.

(Source: Wellcome Trust)

Research with humans (It is arbitrary to consider this a responsibility of the RFO since there are very clear guidelines about ethics approval)

a. Funded researchers must follow best practice guidance on using human participants.
b. Funded researchers must protect the rights, interests and safety of participants
    a. To protect research participants, informed consent should always be obtained, and the informed consent should be communicated in clear and comprehensive language - following the national and institutional guidelines on obtaining informed consent - or informed assent when applicable
c. Funded researchers must comply with all relevant legislation, including data protection and the duty of confidentiality
d. Funded researchers must have all necessary approval and consent in place before the start of the research

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e. Funded researchers must contact the funder if they have any doubts about their research meeting the appropriate regulatory and/or ethical requirements
f. With the exemption of 5a, the above rules apply also where groups or organizations are researched instead of individuals.
g. Not only individual subjects, but also groups, organizations or institutions should be protected. (Source: Wellcome Trust, research involving human participants policy and ERC : https://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/ethics/h2020_hi_ethics-self-assess_en.pdf)
h. Funded researchers will respect human dignity and integrity. (EC Ethics in Social Science and Humanities)
i. Funded researchers will ensure honesty and transparency towards human research subjects. (EC Ethics in Social Science and Humanities)
j. Researchers should respect individual autonomy and obtain free and informed consent (as well as assent whenever relevant). (EC Ethics in Social Science and Humanities)
k. Researchers should protect vulnerable individuals. (EC Ethics in Social Science and Humanities)

Animal research

a. Researchers should adopt a culture of care with regard to the animals and keep themselves informed of developments in good practice of responsible research with animals
b. Ethics committees are responsible for reviewing animal use at local level and addressing situations where there is a risk that the use of animals may be in conflict with the best welfare interests of the animals involved.
c. All experimental work should seek where possible to avoid the use of animals if the work has the potential to cause animals pain, suffering, distress or lasting harm.
d. When conducting animal experiments the 3 R's should be considered: replacement, reduction and refinement
    a. The number of animals used in the entire programme of work should be minimized by careful planning and scheduling of breeding and experiments, and use of appropriate and efficient experimental design.

(National Center for the Replacement, Refinement and Reduction of Animals in Research, adopted by Wellcome Trust)

5b. ethics reporting requirements

a. Where ethics approval is required, this should be obtained for the acquisition of funding. (EUREKA Secretariat materials)
b. An ethical assessment is also strongly recommended for multi-national projects (EU and non-EU countries - collaborations). (EUREKA Secretariat materials)
c. A monitoring/follow up ethic check may occur at all stages and may include a potential on-the-spot visit, interviews and desk reviews. (EUREKA Secretariat materials)

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d. Ethics approval and reporting requirement should be included in the grant Agreement, however they might be discretional. (EUREKA Secretariat materials)
e. The process of ethical appraisal might include several stages: self-assessment, pre-screening and screening, ethics assessment, ethics check, ethic review results. (EUREKA Secretariat materials)
f. Ethical requirements are contractual requirements, they might lead to funding rejection or withheld. (EUREKA Secretariat materials)
g. Researchers should ensure they report human/animal-based studies in accordance with institutional/regional/national regulations and guidelines. (National Center for the Replacement, Refinement and Reduction of Animals in Research, adopted by Wellcome Trust)
h. Researchers should ensure that any new procedures and improvement in human/animal-based research, especially those reducing and avoiding animal use for research, testing or diagnosis are considered. (National Center for the Replacement, Refinement and Reduction of Animals in Research, adopted by Wellcome Trust)

6. COLLABORATION WITHIN FUNDED PROJECTS

6a. expectations on collaborative research

RFOS will expect that:

a. All parties should agree on a collaboration agreement (Wellcome Trust)
b. All institutions should commit to the highest standards of conducting research (Wellcome Trust)
c. All institutions must act accordingly to the existing RI guidelines and regulations (Wellcome Trust)
d. Researchers and host institutions must identify and effectively manage any potential or actual conflicts of interest to ensure the highest ethical standards (Wellcome Trust, CoI policy: Policy part, also for RFO6b)
e. Host organisations must ensure that researcher relationships and activities that might create potential conflicts (consultancies, advisory roles, board memberships) are set out in formal written agreement to protect RFO's best interest (Wellcome Trust, CoI policy: Policy part, host organisations, also for RFO6b)
f. Researchers must inform the RPO before they act as a consultant or adviser to a commercial entity, before they enter any research collaboration, sponsorship or other funding agreement with a commercial entity (CoI, Wellcome)
g. All parties should agree on transferring ownership and/or licensing rights that complies with the RFOs strategy (Wellcome, Data, software and materials management and sharing policy)
h. All parties/Researchers must present a data management plan, that is dynamic and they should review their outputs management plan throughout the whole research cycle (Wellcome, Data, software and materials management and sharing policy)
i. All parties/Researchers should make sure that their outputs are discoverable (Wellcome, Data, software and materials management and sharing policy)

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j. All parties/Researchers should cite the source of the research data, software and materials, and to abide to the conditions and terms under which they were accessed (Wellcome, Data, software and materials management and sharing policy)
k. All parties/researchers should respect and treat fairly their partners from resource-poor/disadvantageus settings (avoid ethics dumping (see: Global Code of Conduct for research in resource-poor settings)

6b. research that is co-financed by multiple funders

a. Any research work should be developed jointly, regardless which institution is the 'leading' partner.
b. All parties should disclose any possible CoI at all stages (suggestion)
c. Data and outcomes should be available to all parties (suggestion)
d. All parties/researchers should respect and treat fairly their partners from resource-poor/disadvantageous settings (to avoid ethics dumping) (see: Global Code of Conduct for research in resource-poor settings)
e. Partners should have/agree on similar peer review standards and criteria (suggestion)
f. Partners should create an overall trust, as the trust component is an essential condition and trust is built through a number of steps, relying on good mutual knowledge of the partners, and involving all hierarchical levels of partner organisations, from top level management to administrative support staff
g. Transparency in decision making process by allowing partners to take part in the review/decision-making panel as observers in order to foster transparency and mutual trust.
h. To respond to budgetary challenges, it is important to introduce a common agreement on success rates; or a common agreement on budget availability/limits; or a hybrid model, including a joint steering committee that takes a final decision.
    a. (European joint programming to address grand societal challenges – ERA-NET/JPI[1])
i. There is a need for alignment by exchanging best practices among RFOs on initiatives with a view to implementing changes to improve efficiency of investment in research at the level of Member States and European Research Area. An existing European initiative is in the context of Joint Programming (JPI) to address joint research priorities.
j. There is a need for simplification and development of common guidelines on terminology, rules and procedures for Research and Innovation (R&I) funding, to be applied throughout the European Research Area on all levels.
k. Parties should continuously revise the core elements (strategic objectives, vision, strategic research agenda (SRA/SRIA), implementation plan) of collaborative projects in the light of new developments and experience gained through implementation.
l. Dissemination and use of research findings is key. Best practice initiatives should contribute to overcoming fragmentation and wasteful duplication of publicly funded research as well as finding research-driven solutions to major societal challenges.
m. Guidelines should be included in relation to peer review procedures, foresight activities, evaluation and funding of cross-border research, optimum dissemination and use of research

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results and the protection, management and sharing of IPRs. Although voluntary, their use is strongly recommended.

n. Joint funding efforts on major European societal challenges such as rare diseases should be made. Guidelines on the ethical, legal and technical requirements of participant identifiers in RD research should be included.

(Science Europe Research Integrity Practices in Science Europe Member Organisations, Survey Report & Science Europe, Lead Agency Procedure Strategies, Op.europe, nature review)

7. MONITORING OF FUNDED APPLICATIONS

7a. financial monitoring

a. **Financial integrity:** The RFO should develop a definition that explains financial integrity. Focus should be put on reducing research waste
b. **Mutual agreement:** Before the start of the research project, a mutual agreement has to be in place between a grant maker and grant receiver regarding financial monitoring, including reporting requirements, expectations and an appropriate timeline. This financial integrity
c. **In house-agreement:** An in-house agreement needs to be in place dividing roles and responsibilities between team members ensuring financial integrity
d. Performance-Based Funding: The financial activities need to be formalized and include detailed policies, implementation of controls over the performance and approval of the funding decision, and improvements in the supporting systems. Gaps, including a lack of clarity in policies and procedures, need to be addressed. These include gaps in preventive and detective controls over the review and approval of the funding decision, and insufficient delineation of roles and responsibilities.
e. **Correcting performance issues**: Continuous performance monitoring ensures the project and funding are not put in jeopardy as major performance issues can be detected in a timely manner. Lack of performance will be regularly discussed and potential withdrawal of allocation of funding should be considered when host institutions cannot guarantee research integrity.
f. **A formalized Quality Assurance Framework** needs to be in place to ensure better financial compliance with the guidelines may be linked to the quality of the research output, including the practice of RI-measures (such as open science).
g. **Ensure an effective oversight body** at the executive management level, with cross functional representation. Grants are currently monitored mostly at a country level (active grants for the country) and, in some limited cases, at the regional portfolio level (active grants in a specific region).

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Note: These recommendation are general. Not specifically meant for research integrity. However, it ensures a sound general framework.

Sources:
https://www.fundingcentre.com.au/help/monitoringhttps://www.theglobalfund.org/media/6930/oig_gf-oig-17-022_report_en.pdf?u=637233413070000000

https://www.theglobalfund.org/media/6930/oig_gf-oig-17-022_report_en.pdf?u=637233413070000000

7b. monitoring of execution of research grant

- **Ensure a mid-term scientific report** to monitor the project and its achievements, but also possible difficulties encountered. The monitoring process is completed in two forms: the monitoring of finances and the monitoring of staff (making sure staff are on track to meet deadlines; supervising staff activities; evaluating the impact of each staff member's activities)

· Sources: https://erc.europa.eu/managing-your-project/scientific-reporting

Note: This recommendation is general. Not specifically meant for research integrity. However, it ensures a sound general framework.

7c. monitoring of compliance with RI requirements

a. **Formulate a detailed and documented plan** to monitor the safety of the research participant according to the risk level of the research.
b. **Information sharing with investigator:** Make sure that the investigator has enough information to notify of any changes to risk information; unanticipated problems involving risks to subjects or others; allegations of non-compliance
c. **Research needs to be conducted in accordance with approved protocols on ethical principles.** Consider the applications of the general principles to specific requirements such as informed consent, risk/benefit assessment, and the selection of subjects of research.
d. **Monitoring & Flexibility clause:** Ensure monitoring of expenditure so that research costs can be met by the grant budget. Unless there are specific restrictions in the award letter, costs between budget headings can be moved. This gives the flexibility to spend funds to benefit research.
e. Monitoring of compliance with the institutional code of conduct
f. Monitoring of education/training in RI by the research team/applicants
g. Monitoring of societal relevance
h. If applicable, monitoring of collaborations with other researchers (in multicenter studies)

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Sources:

- https://research.ucdavis.edu/policiescompliance/irb-admin/researchers/project-guidance/monitoring/
- https://ovpr.uchc.edu/services/rics/hspp/monitoring/
- https://www.hhs.gov/ohrp/regulations-and-policy/belmont-report/read-the-belmont-report/index.html

https://wellcome.ac.uk/grant-funding/guidance/how-to-manage-your-grant-budget

8. UPDATING AND IMPLEMENTING RI POLICY

NOT INCLUDED AS THIS SUBTOPIC IS ALREADY COVERED BY SEVERAL HIGH QUALITY POLICY DOCUMENTS.

9. INDEPENDENCE

9a. What counts as an unjustifiable interference?

Unjustifiable interference is such interference as to compromise the independence of the research. This includes all processes with which the funder can interfere with the research, including setting research agendas, setting out calls, selecting research proposals, selecting reviewers, staff members and all other processes. We should be very delicate here, as institutional and country differences can significantly differ and should highlight this in potential guidelines.

a. The RFO has an extensive description/definition of unjustifiable and justifiable interference
b. The RFO should have policy in place that describes unjustifiable interference and how to deal with the questions below:
    a. What makes it unjustifiable?
    b. How is interference assessed?
    c. What are the consequences of the interference?
c. The RFO will commit to refrain from unjustifiably interfering with any research processes.
d. Special attention will be given to collaboration with industry sponsors, political requests and other external parties

9b. preventing unjustifiable interference by the funder

a. The funding institution and all staff members shall maintain impartial and independent in formulating research agendas, setting out calls, selecting proposals, monitoring research, after the research is presented and all other aspects of research

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b. Potential interference will be regularly assessed by the RFO in several stages of the research process (in the selection of proposal, the monitoring of proposals and the final reporting of the proposal)

9c. preventing unjustifiable interference by political or other external influences

a. The funder maintains in an independent position and is not influenced by any government or external parties and this position will be regularly evaluated
b. The committee members of research funding programs will be regularly screened for potential interference
c. The funder maintains an intermediary position between the government, investigations, the press and other stakeholders
d. Care of process must trump speediness of presentation
e. Communication to the public should run through official communication channels of the funder

9c. preventing unjustifiable interference by commercial influences

In the conduct of public/private research relationships, all relevant parties shall:

a. conduct or sponsor research that is factual, transparent, and designed objectively; according to accepted principles of scientific inquiry, the research design will generate an appropriately phrased hypothesis and the research will answer the appropriate questions, rather than favor a particular outcome;
b. require control of both the study design and the research itself to remain with scientific Investigators
c. not offer or accept remuneration geared to the outcome of a research project;
d. prior to the commencement of studies, ensure that there is a written agreement that the investigative team has the freedom and obligation to attempt to publish the findings within some specified timeframe;
e. require, in publications and conference presentations, full signed disclosure of all financial interests;
f. not participate in undisclosed paid authorship arrangements in industry-sponsored publications or presentations;
g. guarantee accessibility to all data and control of statistical analysis by investigators and appropriate auditors/reviewers; and
h. require that academic researchers, when they work in contract research organizations or act as contract researchers, make clear statements of their affiliation; require that such researchers publish only under the auspices of the contract research organizations.

Sources independence:

- https://ajph.aphapublications.org/doi/10.2105/AJPH.2018.304677

- https://pubmed.ncbi.nlm.nih.gov/23432773/
- https://theconversation.com/when-big-companies-fund-academic-research-the-truth-often-comes-last-119164
- Cullerton, K., Adams, J., Forouhi, N., Francis, O., & White, M. (2019). What principles should guide interactions between population health researchers and the food industry? Systematic scoping review of peer-reviewed and grey literature. *Obesity Reviews*, *20*(8), 1073-1084.
- Rowe, S., Alexander, N., Clydesdale, F., Applebaum, R., Atkinson, S., Black, R., ... & Lupton, J. (2009). Funding food science and nutrition research: financial conflicts and scientific integrity. *Nutrition reviews*, *67*(5), 264-272.

10. PUBLICATION AND COMMUNICATION

10a. publication requirements

Not included as this subtopic is already covered by several high quality policy documents.

10b. expectations on authorship

Not included as this subtopic is already covered by several high quality policy documents.

9c. open science

Not included as this subtopic is already covered by several high quality policy documents.

11. INTELLECTUAL PROPERTY ISSUES

No subtopics and not included in the creation of the SoRs.

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APPENDIX 2. Methodology towards the co-creation workshops

The following is largely taken from the pre-registration of the co-creation workshops available at https://osf.io/8upmb/ on the Open Science Framework SOPs4RI project (http://dx.doi.org/10.17605/OSF.IO/E2BSJ).

Title: SOPs4RI co-creation workshops

Authors: Krishma Labib, Daniel Pizzolato, Borana Taraj, Iris Lechner, Nik Claesen, Natalie Evans, Pieter Jan Stappers, Katinka Bergema, Kris Dierickx, Joeri Tijdink

Introduction

Although research integrity (RI) has been traditionally defined as the opposite of research misconduct (1), there is increasing acknowledgement that RI is also about improving research quality and relevance (2, 3). RI is not only influenced by the attitudes and behaviors of individual researchers, but by the entire system of science (4-6). For instance, the incentive structure and culture of publication in research have strong ramifications for RI (4). Furthermore, multiple research stakeholders play a role in how research is conducted, including research performing and research funding organizations (RPOs and RFOs); these have a responsibility in promoting and supporting responsible research practices (7). Therefore, fostering RI is a complex – even what is referred to as a 'wicked' (8) – endeavor, since it requires adequately addressing the interplay of various factors and stakeholders that have an impact on research (7).

In a recent study we conducted as part of the Standard Operating Procedures for Research Integrity (SOPs4RI) project, we identified a number of topics that RPOs and RFOs should address to effectively foster RI and build a comprehensive RI system in their institutions (9, Preprint). While there are guidance documents that address some of these topics from an organizational perspective (e.g. dealing with breaches of RI), others (e.g. research environment) are currently not adequately addressed by good quality guidance documents which are publicly available (10, 11). The lack of guidance available on some of the topics (the 'underdeveloped' topics) makes it difficult for RPOs and RFOs to know which institutional policies to implement, and how, in order to increase RI.

To help RPOs and RFOs develop and implement effective institutional RI policies, it is important to design standard operating procedures (SOPs) and guidelines on underdeveloped RI topics, that are practical and to-the-point, meet the needs of end-users and are feasible to implement. Co-creation – in which researchers acknowledge and encourage end-users as active, equal contributors to the goals at stake (12) – can be helpful to achieve this (13). There are a few features of co-creation that make it a suitable methodology for producing new institutional SOPs/guidelines on RI for RPOs and RFOs.

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First, engaging stakeholders not only in the implementation phase of guideline development, but also in the front-end of the design process (i.e. guideline ideation and production) allows for the creation of of guidelines that end-users (e.g. institutional policy makers) find helpful and are likely to use, thereby increasing the likelihood of implementation. Secondly, co-creation incorporates design methodology to promote out-of-the-the-box thinking (12), which is crucial to finding innovative solutions to deal with the complexity of RI (i.e. the interplay of factors that influence it). Finally, by asking stakeholders to not only 'say' (e.g. talk about their dream vacation) as in traditional qualitative methods, but also to 'make' and 'do' (e.g. drawing their dream vacation or engaging in role playing), co-creation exposes stakeholders' latent values, which they themselves might not be consciously aware of (12). Exploring stakeholders' values is important to obtain a sufficient depth of understanding about RPOs' and RFOs' needs, wants and concerns on the topics at hand.

Therefore, in SOPs4RI, we are conducting co-creation workshops to develop content for underdeveloped topics we have identified as important to address in the institutional RI policies of RPOs and RFOs. This protocol outlines the co-creation methods that we will use in the process of guideline creation in the SOPs4RI project.

Aims

Our co-creation workshops have three main aims:

1. Develop 'skeleton guidelines' (rough version drafts of a guideline) on a selection of RI topics, targeted at the institutional level of RPOs and RFOs, together with RPO and RFO stakeholders.
2. Explore which guideline formats stakeholders prefer, regarding issues such guideline prescriptiveness, level of detail, guideline structure, etc.
3. Identify potential implementation issues of the created skeleton guidelines and explore ways to address them.

Methods

Ethical considerations

The protocol for the workshops has been approved by the Institutional Review Board of KU Leuven, under *dossier n. G-2020 01 1945*. When inviting participants to partake in the workshop, we provide them with complete information describing our study aims and research procedures, use of data, and privacy policy. Participants are required to provide written informed consent prior to partaking in the study.

Selection of topics to address

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Since some of the topics to be included in the SOPs4RI toolbox are already addressed by good existing resources, and some are not appropriate for the co-creation methodology, we used the following inclusion criteria to determine which RI topics to target during the co-creation workshops:

- The topic is underdeveloped – it is not addressed by good quality existing resources.
- Topics prioritized higher in the SOPs4RI project take precedence over lower ranked topics — based on the rankings from the SOPs4RI Delphi study (9, Preprint)
- The topic is not legalistic/procedural – such topics are not suitable for co-creation workshops.

Based on these inclusion criteria, we have chosen the following RI topics to address in the SOPs4RI co-creation workshops:

1) Topics targeted at RPOs:
   α) education & training in RI,
   β) responsible supervision & mentoring,
   χ) research environment
2) Topics targeted at RFOs:
   a) selection and evaluation of proposals,
   b) monitoring, and
   χ) independence.

Each of the topics contains a number of subtopics. More details on the topic selection and list of subtopics per topic can be found in the file 'Topic selection' (available here: https://osf.io/myqe5/).

Workshops

We conducted the workshops on 4 separate dates in 2020: October 8, October 21, November 24/25 (two half days); and December 9. The earlier sets of workshops (i.e. those on October 8 and 21) focused on creating content for the skeleton guidelines, while the later sets of workshops (i.e. those on November 24/25 and December 9) focused on refining the content for the guidelines. The workshops on October 8 and November 24/25 addressed the same three topics (selection and evaluation of proposals; independence; and responsible supervision and mentoring), while the workshops on October 21 and December 9 addressed the other three topics (RI education and training; research environment; monitoring).

Due to the COVID-19 pandemic, all the workshops took place digitally. We used Zoom (https://zoom.us/) and the collaborative whiteboard software MIRO (https://miro.com/) to meet with participants and interact. We conducted a separate workshop per topic for each workshop date (e.g. a separate workshop for the topics selection and evaluation of proposals, independence, and responsible supervision and mentoring on October 8). Due to the online nature of the workshops, each workshop lasted 3 hours and included 3-6 participants. However, to maximize the input we

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obtained and consulted additional participants. We repeated each workshop on the same day, but with different participants (e.g. the workshop on the morning of October 8 was repeated with a different group of participants in the afternoon of October 8).

Each workshop was led by a facilitator who was responsible for the process of the workshops (JT, NE, KL). A co-facilitator was responsible for the technical aspects of the workshop and for supporting the facilitator (DP, IL, BT). The facilitators and co-facilitators were supported by a trained independent facilitator (KB). Additionally, the general approach to both the earlier and later sets of workshops was piloted with a few members of the SOPs4RI consortium a few days before the workshop; the piloting was only used to test the workshop plans and conduct some troubleshooting, not to generate data.

Participant recruitment

We are recruiting a minimum of 8 participants per topic for each workshop date (i.e. 24 participants in total per workshop date). We selected participants who work for RPOs, RFOs or other types of research organizations (e.g. publishers, journals, government organizations, etc.), who have some knowledge or interest in the selected RI topic in the workshop. Participants should display diversity in terms of experience, profession role, country, gender, and disciplinary field. A purposive recruitment and sampling strategy was used by 1) using already existing databases developed by other EU funded projects or EU organizations (ENERI, EnRIO, EARMA, ERION) to identify potential participants, 2) involving participants who have already been included in earlier stages of the SOPs4RI project (e.g. Delphi study, focus groups), and 3) snowballing. We deliberately included some overlap in the participants who joined the first and second sets of workshop for the same topic (e.g. we included some of the same people for the workshop on 'independence' on October 8 and November 24/25).

Co-creation process

The process of the SOPs4RI co-creation workshops project consists of the following steps:

1. Creating *inspirations*
2. Sensitizing participants
3. Conducting the first set of workshops (October 8 and October 21)
4. Creating skeleton guidelines V1
5. Conducting the second set of workshops (November 24/25 and December 9)
6. Creating skeleton guidelines V2

In the following section, each of these steps is explained in more detail:

1. *Creating inspirations*

The main input of the co-creation workshops are a set of *inspirations* we have created per topic (and subtopic). In an earlier phase of the SOPs4RI project, sets of recommendations to RPOs and RFOs

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have been created per topic included in the co-creation workshops, based on existing resources — which are incomplete or of low quality – and discussions amongst the SOPs4RI project. To present the co-creation workshop participants with the recommendations in an easy to grasp manner, but still give them the freedom to create guidelines that do not necessarily align with these recommendations, we translated these recommendations into *inspirations*. We did this by going through each of the recommendations per topic, and highlighting the key elements (i.e. key two/three words) of the recommendation. Next, we decided whether to include or exclude that key element in the inspirations. The main reason for exclusion was overlap between different elements, but elements could also be excluded if we deemed that we already have sufficient knowledge on that element (e.g. we excluded most elements related to the content of RI education & training, since there is already a lot of literature available on this issue). We translated the included elements into *inspirations* by either capturing them in one or two keywords shown in different formats (e.g. the recommendation to carry out more research on good supervision was translated into the key words 'more research'), or by finding open source pictures that could represent those elements (e.g. the recommendation that supervisors should acknowledge their mentees' accomplishments was captured in a picture where a cartoon figure shows a thumbs up sign). The *inspirations* for three of the topics were created by KL, while the other three topics' *inspirations* were created by IL; KL and IL also reviewed the entire selection and translation process of the other 3 topics. Furthermore, the entire co-creation team reviewed the final *inspirations*. Although based on concrete recommendations, the *inspirations* are ambiguous and can be interpreted in different ways. This ambiguity is important to evoke creativity in the workshop participants and to give them room to bring in the elements they find most important into the workshop discussions.

2. *Sensitizing participants*

To prepare the participants for the workshops, we sent them a sensitization package including the *inspirations* and information about the co-creation workshops and SOPs4RI project. The package was sent via email and – when participants consented – also via live mail. Furthermore, we arranged short 15 minute one-on-one calls with each participant to get them familiarized with the Zoom and MIRO software programs. During these short calls, we invited participants to consider the profile of research institutions by writing down, on the MIRO boards, some thoughts about research institutions' responsibilities, interests, and pressures faced. This helped us to ensure that participants were ready to think of guidelines targeted at the level of RPOs and RFOs during the workshops, rather than at the level of individual researchers. Finally, before the workshops, we asked the participants to have a look at the *inspirations* and select 3 which they find particularly striking and write down why on the MIRO board. This ensures that they become familiarized with the *inspirations.*

3. *Conducting the first set of workshops (October 8 and October 21)*

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In the first set of workshops, the aim was to generate content for the skeleton guidelines per topic, as well as to explore which guideline formats stakeholders prefer for the respective topic. The workshop consisted of 4 parts:

- **Introduction** – In this part, workshop facilitator and co-facilitator introduced the workshop plan and goals. To break the ice and get participants familiarized with each other, the facilitator asked participants to share which *inspirations* they selected as part of the sensitization process and why.
- **Idea generation exercises** – The main part of the workshop consisted of exercises aimed at creating ideas for skeleton guidelines per subtopic of each topic. The exercises for each subtopic (and, hence, topic) are unique. The general approach for each exercise is to ask participants to individually write down on MIRO what should be in guidelines on the subtopic at hand, based on their own experiences and knowledge of the topic. Here, participants were encouraged to get inspiration from the *inspirations*, which were made available on the MIRO board. Following this, the participants were encouraged to discuss what they have written down with each other, in order to build on each other's ideas. At the end of each exercise, each participant was asked to mention what the most important takeaway message for them is from this exercise.
- **Guideline format** – After discussing the content of the guidelines, the participants were asked to think about what kind of format is suitable for the guidelines. They were provided with three example RI guidelines (14-16), which were not specific to the topic of the workshop, and were asked to comment on the format of these guidelines individually on the MIRO board. Following this, they discussed the appropriateness of these formats for the topic of the workshop.
- **Conclusion & evaluation** – At the end of the workshop, participants were provided with a set of 20 ambiguous pictures not related to RI (e.g. a picture of a closed door). They were asked to select one or two of these pictures, or find an alternative picture themselves, which they could use to discuss what their main take-away from the workshop was, as well as how they experienced the workshop. Furthermore, participants were informed of the next steps of the co-creative process.

4. *Creating skeleton guidelines V1*

Based on the insights gained about the skeleton guideline content and format in the afternoon and morning workshops for each topic, we created a first version of the skeleton guidelines. Additionally, we identified any remaining gaps for each subtopic and topic. We then sent the prepared skeleton guidelines to the participants of the next workshops on the respective topics and asked them how implementing these guidelines would impact them and their institutions. The participants were invited to submit a sentence or two on this on MIRO, as part of the sensitization process for the second set of workshops.

5. *Conducting the second set of workshops (November 24/25 and December 9)*

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The main focus of the second set of workshops was to refine the drafted skeleton guidelines, by exploring implementation issues. Therefore, the workshop consisted of 5 parts:

- **Introduction** – The workshop facilitator and co-facilitator introduced the workshop plan and goals. To break the ice and get participants familiarized with each other, the facilitator asked the participants to share what they submitted as part of the sensitization exercise, in which they were asked to write down how the skeleton guidelines will impact them and their institutions.
- **Stakeholder mapping** – The participants were asked to identify all the stakeholders that have a role to play in the implementation of the skeleton guidelines and/or were affected by them. Additionally, participants were asked to jointly select which two stakeholders were the most important to explore further in the workshop. They then had the opportunity to explore in more detail 1) what the role of these two stakeholders is and 2) how they are impacted by the guidelines.
- **Impacts, resources, opportunities, threats** – In this exercise, participants explored the impacts, resources, opportunities and threats of the skeleton guidelines on the overall institution (RPO or RFO) by first individually writing down their impressions of each of these, and then using the discussion to build on each other's ideas.
- **Refinement of guidelines** – Each participant was asked to share, based on the insights generated in the earlier exercise, what their main points of feedback are to V1 of the skeleton guidelines. These included implementation issues, unintended consequences of the guidelines, barriers and facilitators to implementation, and resources needed for implementation of the guidelines. Participants then selected one point they believed needed most attention, and explained their choice and concerns.
- **Conclusion & evaluation** – At the end of the workshop, participants were asked to describe how they felt about the workshop, and to explain any remaining thoughts they did not have a chance to express. Participants were also informed of the next steps of the co-creative process.

6. Creating skeleton guidelines V2

We integrated the feedback from the participants in the second set of workshops to refine the first version of the skeleton guidelines and produce V2 of the guidelines. We will then send V2 of the skeleton guidelines to all the workshop participants that were involved in the guidelines for that topic via email, to ask them for any additional feedback. Any additional input will be used to finalize the skeleton guidelines.

Data collection and analysis

During the workshops, we audio- and video- recorded the Zoom screen. Additionally, we used the screen recording software Xbox Game Bar to record the MIRO board throughout the workshops. The audio recordings were transcribed using the programme Amberscript (https://www.amberscript.com/en/). All data will be stored on Aarhus University's (the SOPs4RI's

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coordinators') Sharepoint for 5 years, except the video recordings which will be destroyed after data analysis. Only those involved in the organization and analysis of the co-creation research of SOPs4RI have access to the audio and video recordings.

The analysis of the data was done in an inductive (analysis of the first sets of workshops) and deductive fashion (analysis of the second sets of workshops) by the co-creation team. The data was organized into the following elements per topic and subtopic:

- Institutional measures/recommendations per topic/subtopic
- Rationale for each measure
- Guideline format considerations for the topic/subtopic
- Implementation issues (facilitators and barriers)
- Ideas on how to address implementation challenges
- Flagging of issues to explore/research further

Data analysis was conducted both after the earlier sets of workshops in October, as well as the later ones in November/December. This ensured that we can build both V1 and V2 of the skeleton guidelines based on the full insights we obtain from analyzing the data. To build the skeleton guidelines, we designed the guidelines for each topic according to the format discussed by participants in the October workshops. The content of the guidelines include the institutional measures/recommendations that were agreed on during the October workshops, and that were then later refined in the November/December workshops.

Additionally, to make use of the sets of recommendations that were generated in earlier phases of the SOPs4RI project (which the *inspirations* for the workshops are based on), we check which sets of recommendations align with the outputs generated during the October workshops. When the sets of recommendations from earlier stages of the SOPs4RI project align with any of the measures/recommendations generated during the October workshops, we merge insights from both the sets of recommendations from the earlier SOPs4RI work and the co-creation workshops into skeleton guidelines V1. Consequently, the participants of the November/December workshops had the opportunity to comment on, not only the measures/recommendations generated during the October workshops, but also on whether it is appropriate to include the details from the earlier SOPs4RI work into the skeleton guidelines.

<u>Evaluation of the workshops</u>

Since using co-creative methods to create RI guidelines is a relatively novel approach, we will also evaluate the process of using co-creation to create our guidelines. For the evaluation, we will make use of participants' input during the 'conclusion and evaluation' session in each workshop. Additionally, we carried out informal follow-up evaluation interviews with one participant from each workshop. During this interview, we asked participants to share their general impression of the workshop, including what they appreciated and what can be improved about the workshop. We also

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asked them to provide their input on specific workshop exercises, as well as to reflect on the output generated from the workshops. The interviews were not recorded; notes of participants' input were made instead. We will send the notes to the participants after the interview to carry out a member check.

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