SOPs4RI

D3.4: Reports on the rounds on the Delphi procedure

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Project title: Standard Operating Procedures for Research Integrity
Project acronym: SOPs4RI
Grant Agreement no.: 824481
Lead contractor for this deliverable: Amsterdam University Medical Center

The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824481.

Coordination and Support Action

H2020-SwafS-03-2018

Project full title

"Standard Operating Procedures for Research Integrity"

Project acronym

SOPs4RI

Grant Agreement No.

824481

D3.4: Report on the rounds of the Delphi procedure

Editor:	Krishma Labib & Joeri Tijdink
Version:	1.0
Dissemination level[1]:	PU
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Due date of deliverable:	31 October 2019
Actual submission date:	24 October 2019
Start date of project:	01 January 2019
Duration:	48 months
Organisation name of lead contractor for this deliverable:	Amsterdam UMC

[1]This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824481

PU – Public; PP – Restricted to other programme participants (including the Commission Services); RE – Restricted to a group specified by the consortium (including the Commission Services); CO – Confidential, only for members of the consortium (including the Commission Services).

Document metadata

Version	*Date*	*Modification reason*	*Modified by*
0.1	05-10-2019	First draft	Labib, Mokkink, Bouter, Widdershoven, Evans, Tijdink, Ščepanović, Marušić
0.2	06-10-2019	Review	George Gaskell
0.3	15-10-2019	Revised	Labib, Evans, Tijdink
0.4	16-10-2019	Review	Niels Mejlgaard and Mads P. Sørensen
1.0	24-10-2019	Final edit	Labib, Mokkink

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1. Introduction

1.1 Abbreviations

RI – Research Integrity

SOP – Standard operating procedure

RPO – Research performing organisation

RFO – Research funding organisation

RIPP – Research Integrity Promotion Plan

ALLEA Code – European Code of Conduct for Research Integrity

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 at guiding 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 scientific evidence. They may include checklists.

Standard Operating Procedure (SOP): a detailed, written instruction, aimed at achieving uniform action step-by-step.

SOPs prescribe specific actions; they liberate users from having to figure out the right decision by themselves, through ensuring that a certain procedure is followed. They may come in the shape of a 'decision-tree'/flow-diagram, similar to an algorithm in clinical contexts.

Toolbox: a structured collection of easy-to-use 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. It is the intention that RPOs and RFOs should form their own RIPPs taking into account relevant national and local regulatory and organisational procedures.

1.3. About SOPs4RI

As stated in the grant agreement, the Standard Operating Procedures for Research Integrity (SOPs4RI) project aims to contribute to the promotion of excellent research and robust research integrity cultures aligned with the principles and norms of the European Code of Conduct for Research Integrity. The overall objective of SOPs4RI is to create a toolbox to support and guide research performing organisations (RPOs) and research funding organisations (RFOs) in fostering research integrity (RI) with the aim of preventing questionable research practices (QRPs) and preventing, detecting and handling research misconduct. The project focuses on providing Standard Operating Procedures (SOPs) and guidelines that will make it possible for RPOs and RFOs to create and implement Research Integrity Promotion Plans (RIPPs). SOPs4RI will thus stimulate transformational processes across European organisations involved in performing and funding research. SOPs4RI takes a mixed-method, co-creative approach to the development and empirical validation of

SOPs and guidelines. The expected 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 development of SOPs and guidelines will take national, disciplinary, and organisational differences into account, and the final toolbox will enable users to create Research Integrity Promotion Plans (RIPPs) according to the needs of their organisation. The ultimate goal of the project is to guide RPOs and RFOs in creating RIPPs that will support, require and encourage researchers in doing research responsibly.

1.4. About Work Package (WP) 3 – Systematic review of practices and research cultures

To develop a toolbox to support RPOs and RFOs in fostering RI and preventing QRPs and research misconduct, as well as detecting and handling research misconduct, WP3 aims to create the first necessary evidence base. This will comprise factors that have a positive or negative influence on the implementation of RI in RPOs and RFOs, a model of the culture of research systems in different disciplines, knowledge on existing practices for RI promotion, and important topics for institutional efforts in fostering RI. WP3 has already contributed to the aim of the SOPs4RI project with the following:

1) Two literature reviews and the modelling of research cultures

A comprehensive literature search was conducted to explore all relevant knowledge that may contribute to the aim of SOPs4RI. In parallel two scoping reviews, focussing on best practices for RI promotion in RPOs and RFOs and factors influencing the implementation of the practices for RI, were conducted. In addition to the literature review, the first task

included the development of a framework to model research cultures in different disciplines. The framework is designed to contribute to a better understanding of the impact of research culture on researchers and RI.

2) Expert interviews

The knowledge identified through the literature review was further explored in interviews with RI experts. The interviews included stakeholders with different roles regarding RI.

3) Delphi survey studies

Two identical Delphi survey studies were conducted to contribute to identifying which topics to include in the SOPs4RI toolbox for RPOs (study 1) and RFOs (study 2).

1.5. About deliverable D3.4

Deliverable 3.4 provides a report on the results and process of the two Delphi studies that are part of WP3.

2. Report on the round of the Delphi studies

2.1. Introduction

Increasingly, research integrity (RI) is recognized not only as being about research misconduct, but also about improving the quality and relevance of research (1). There are features at three different levels that influence RI: i) individual researchers, ii) institutions where researchers work at, and iii) the wider system of science (2-5). At the level of individual researchers, researchers' attitudes and behaviours determine to what extent research adheres to RI standards (6, 7). At the institutional level, the policies, facilities and the culture of the research performing organisations (RPOs) influence researchers' attitudes and behaviours (8, 9). Multiple factors are thought to have an impact on RI at the level of the system of science, with journals and publishers, and funders being amongst the most important.

On the one hand, journals and publishers determine what research is published and in what form, and therefore have an impact on the quality of publications (10, 11). For example, the ease with which journals allow researchers to publish research in an openly accessible way; the quality of the peer review process that journals offer; as well as the requirements that journals place on what articles should include to be published (e.g. reporting of conflicts of interest), all have an impact on RI. On the other hand, research funding organisations (RFOs) decide what research will actually take place, and therefore have an impact on competition for research funds (which affects researchers' behaviour) and the research questions that are considered important. For instance, the requirements (e.g. on using appropriate research methods) that funders pose on researchers who aim to receive funds influence the research that is performed. In these ways, RFOs can influence

research quality (4). To effectively foster RI, it is important to address each of these three different levels, as they all have an important impact on RI.

Currently, there are many resources in the forms of Codes of Conduct, guidelines and Standard Operating Procedures (SOPs) on RI for individual researchers (e.g. the European Code of Conduct for Research Integrity) (5, 8), and journals and publishers (e.g. COPE guidelines) (12). However, there are few resources available, which provide guidance specifically to RPOs and RFOs. The Standard Operating Procedures for Research Integrity (SOPs4RI) project aims to fill this gap by developing a publicly available online toolbox containing SOPs and guidelines for RI targeted at RPOs and RFOs. To provide guidance to RPOs and RFOs, it is important to consider the different dimensions of RI that RPOs and RFOs can influence.

For instance, the EU funded Bonn-Printeger statement lists several topics that RPOs should address to foster RI, such as providing education, training and mentoring for RI, improving the organisational research culture, protecting whistle-blowers and protecting researchers from unfounded accusations, etc. (13). Similarly, the International Funders' Collaboration 'Ensuring value in research' highlights several areas that RFOs should address, such as research design, research reporting and publishing (14). Although this shows that several topics have been identified as important for organisational efforts at promoting RI, to our knowledge there is currently no systematic empirical evidence of which RI topics are deemed most important by experts in RPO and RFO policy.

2.2. Research aims

The aim of the Delphi study which is part of the SOPs4PI project was to seek a consensus among research policy experts on what are important topics to tackle in organisational efforts to foster RI in i) RPOs and ii) RFOs. More specifically, we investigated the questions:

1) What are important topics to address for fostering RI in RPOs and RFOs, and 2) How should these topics be prioritized when developing policies on RI at RPOs and RFOs? Addressing these questions provides insights into the topics that should be included in the SOPs4RI toolbox.

2.3. Methods

The Delphi technique consists of a series of surveys, or 'rounds', in which a panel of experts provide their opinion on proposals raised by the researchers (15-17). After each round the responses are analysed, and are fed back to the experts with the aim of moving towards a consensus of opinion as the rounds progress (15, 18). In order to address the unique priorities of RFOs and RPOs, we conducted two parallel Delphi studies, each with two rounds as depicted in Figure 1. Study 1 was focused on RPOs, while Study 2 was focused on RFOs. The protocols of the studies were registered on OSF and can be found here.

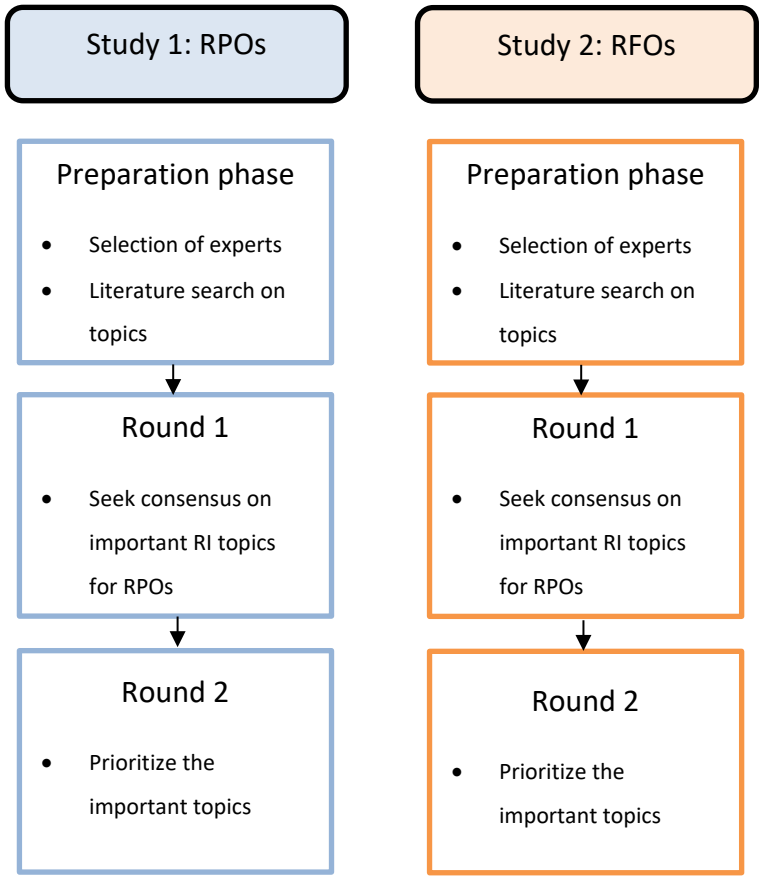

Figure 1. The SOPs4RI Delphi procedure

2.3.1. Preparatory phase

2.3.1.1 Recruitment of experts

We defined experts as people with expertise (i.e. working experience) in research policy at RPOs (study 1) or RFOs (study 2). This included research policy makers (e.g. deans, rectors, science policy officers, etc.) and enforcers (e.g. research integrity officers), as well as research policy researchers. To ensure that the SOPs4RI toolbox would be applicable across

Europe, participants were not limited to those with research integrity policy expertise, but included representatives from countries that do not yet have a strong RI agenda. A purposive sampling technique was used to identify potential experts; we used personal contacts of SOPs4RI consortium members, followed by a snowballing approach. Additionally, we performed a web search of research policy contacts in three RPOs and RFOs in each country in the European Research Area (ERA) to identify additional experts. The identity of the experts was only known to K.L. and J.T., who were responsible for correspondence, in order to ensure anonymity of the responses.

2.3.1.2 Literature search on topics

To identify a preliminary list of RI topics to present to experts in Round 1, we conducted a literature search of English language RI SOPs, guidelines and Codes of Conduct written after 2000. We started by searching for documents from 1 RPO and 1 RFO in each country in the ERA, Australia, the USA, and Canada from which we extracted RI topics and potential subtopics. Once saturation was reached, i.e. no new topics emerged, we made two documents with a preliminary list of topics and subtopics for 1) RPOs and 2) RFOs, taking into account overlap between topics and the relations between topics. Topics were themes that were quite broad and included multiple sub-issues, while subtopics were the more specific issues that belonged to the overall topic. We circulated the lists of topics among the research group and several members of the SOPs4RI consortium to refine them (e.g. remove duplicates, alter phrasing, add additional topics/subtopics, etc.). Following this, the lists were ready to present to experts; the list for RPOs can be found here and for RFOs here.

2.3.2. Round 1

In Round 1 we sought to obtain consensus on which topics are important for organisations in fostering RI, i.e. which topics should be included in the SOPs4RI toolbox (research question 1). To reach this objective, we asked experts to rate each topic identified in the preparatory phase on a 1-5 Likert rating scale, ranging from the topic is 'not important at all', to it is 'absolutely essential' for institutional efforts in fostering RI, in an online Qualtrics survey. When experts gave a topic a rating of 3 or higher, they were also able to rate the subtopics we had identified under that topic by selecting 'Include' or 'Do not include' under the topic. Experts were also encouraged to provide comments and arguments for their ratings. Additionally, they had the opportunity to suggest new topics and subtopics. Before we sent out the surveys for Round 1 to all experts, we first piloted them with 2 experts from RPOs and 3 experts from RFOs, respectively, whose input we included in the overall analysis of the study. Based on the feedback of the pilot experts, we made some final adjustments in the survey and we also refined the lists of topics further.

To analyse the responses of Round 1, we looked into the percentage agreement of ratings 4-5 for each topic, as well as the percentage agreement for a rating of 'Include' for each subtopic. We had originally defined consensus as 67% agreement among the experts on ratings 3-5 per topic (i.e. 2/3 of the experts rating the topic as moderately important – absolutely essential). However, by using this threshold we were unable to see differences between the topics. Therefore, we retrospectively raised the threshold for consensus to 67% agreement on ratings 4-5 (very important – absolutely essential). After determining topics for which consensus was reached, we were able to make proposals for adjustments to the list of topics that we were aiming to use in Round 2; adjustments included excluding certain topics, rewording other topics, etc. In order to determine whether to propose inclusion or exclusion of a topic in Round 2, we also looked into the qualitative arguments provided by the experts. Additionally, we conducted a thematic content analysis of the

qualitative data to identify any general concerns the experts raised about the SOPs4RI toolbox. We excluded responses from experts who completed 50% or less of the survey, as this indicated that they failed to complete an assessment of all the topics and subtopics, making it difficult to interpret their results.

2.3.3. Round 2

The main objective of Round 2 was to rank the topics which achieved consensus in Round 1, in order of priority (research question 2). To reach this objective, experts were asked to select 6 or 5 topics to prioritise from the list of topics found important in Round 1 for RPOs and RFOs, respectively. We asked the experts to prioritise the topics based on their potential to have impact on research practice. Next, the experts were asked to rank these chosen topics in order of priority, with a score of 1 indicating the highest and 6 the lowest rank. For the analysis, we looked at the number of experts who prioritised each topic. Additionally, to create a ranking based on the collective ranking of the experts, we summed up the scores of all the experts for each topic; topics with a lower summed score received a higher rank. To compensate for the fact that each expert only had to rank the topics she initially prioritised, we assigned topics that were not prioritised by each expert a ranking score of 9,5 or 8,5 in the RPO and RFO study, respectively (i.e. every topic that expert A did not prioritise in the RPO study received a score of 9,5, while the topics she prioritised received scores between 1-6).

Furthermore, based on experts' responses in Round 1, we identified three further smaller objectives in the second round: 1) to provide feedback on general concerns raised about the toolbox to the experts; 2) to obtain insight into whether SOPs or guidelines are more appropriate for each topic and identify potential excellent existing SOPs or guidelines; and 3) to achieve consensus on newly proposed topics and on subtopics with no consensus

from Round 1. To meet objective 1, we provided experts with a summary of the results of Round 1. We highlighted the general concerns that were raised in Round 1 about the toolbox, provided our response to these concerns and asked the experts to express their opinion on our response to the concerns raised.. We collected and analysed their responses; these will serve as starting points for studies in further stages of the SOPs4RI project.

In relation to objective 2, experts were asked to indicate whether SOPs or guidelines are more appropriate for each of the topics they prioritised. When analysing the responses, we looked into the number of experts who opted for SOPs over guidelines, or vice-versa, as well as the arguments provided. Additionally, in line with objective 3, we asked experts to rate the topics with no consensus as well as newly proposed subtopics from the previous round, based on a summary of the results. As in Round 1, we looked into the percentage of experts who agreed with our proposals, and we defined consensus as agreement by 67% of the experts. We also looked into the qualitative arguments provided for inclusion or exclusion to make a final decision. Following the conduct and analysis of Round 2, a complete feedback report of the results will be sent to all experts who took part in the study, providing them with a chance to respond.

2.4 Results

2.4.1 Respondents

A total of 119 experts completed one or both rounds of the two Delphi studies combined (Table 1). They were diverse in terms of gender, country, and the disciplinary background of their organisation. A large majority (>96%) of the experts in both studies considered themselves at least moderately experienced in RI issues as policy makers, policy enforcers or researchers. The experts' characteristics can be found in Table 1. A few (n=11) of the

experts invited to the study who did not participate provided us with reasons for declining the study, including conflicting duties, lack of time, illness, personal reasons and retirement. Some of the experts (n=5) mentioned that only one person from their organisation would complete the study, rather than each person we invited.

Table 1: Characteristics of the respondents in the RPO and RFO studies

Characteristics	RPO study		RFO study	
	Responses	**Percentage**	**Responses**	**Percentage**
Response rate				
Round 1				
complete responses	51/305	17	39/215	18
*incomplete responses**	6/305	2	4/215	2
Round 2				
complete responses	50/305	16	36/215	12
incomplete responses	2/305	1	1/215	0
TOTAL (# of experts participating in one or both of the Delphi rounds)	69/305	23	54/215	25
RPO type				
University/university hospital	49	67		
Industry	1	1		
Intergovernmental organisation	5	7		
Independent research institute	8	11		
Other	5	7		
Missing	5	7		
Disciplinary field of organisation				
Humanities	26	20	22	20
Social sciences	33	26	26	24
Natural sciences	30	23	25	23
Biomedical sciences	35	27	30	28
Missing	5	4	5	5
Gender				
Female	30	43	27	50
Male	32	46	19	35

Non-binary	0	0	0	0
None of the above	0	0	0	0
Prefer not to disclose	2	3	2	4
Missing	5	7	6	11
Country				
Outside Europe	4	6	10	19
Northwestern Europe & Scandinavia	31	45	22	41
Southwestern Europe	10	14	2	4
Northeastern Europe	5	7	0	0
Southeastern Europe	5	7	6	11
Central Europe	7	10	7	13
Missing	7	10	7	13
TOTAL number of countries	28		26	
Research policy experience				
Mean number of years	14,3		13,8	
Maximum number of years	50		60	
Minimum number of years	1		2	
Missing	6		7	
Degree				
PhD/Doctorate	50	72	35	65
Master	12	17	13	24
Bachelor	2	3	0	0
Missing	5	7	6	11
RI experience				
Not experienced at all	1	1	0	0
Slightly experienced	2	3	1	2
Moderately experienced	25	36	21	39
Very experienced	28	41	13	24
Extremely experienced	8	12	13	24
Missing	5	7	6	11

The table shows the response rate and demographic characteristics of the respondents. Some experts participated in both rounds, while others only completed one round of the Delphi. That is why the TOTALs in the response rate are not a simple sum of the number of respondents in Rounds 1 and 2. For the items on 'Type of RPO' that the experts worked in, 'Disciplinary field of the organisation', and 'Gender', experts could indicate multiple options. For the item 'Country', experts had to state the country that they mainly worked in. The categories of countries seen in the table were grouped as follows: ***Central Europe*** *included Austria, Slovakia, Czech Republic and Hungary;* ***Northwestern Europe and***

Scandinavia *included Ireland, UK, Netherlands, France, Belgium, Luxembourg, Germany, Switzerland, Denmark, Norway, Finland and Sweden****; Southwestern Europe*** *included Portugal, Spain and Italy;* ***Northeastern Europe*** *included Estonia, Latvia, Lithuania, Ukraine, Belarus, Poland and Russia;* ***Southeastern Europe*** *included Romania, Bulgaria, Greece, Moldova, Serbia, Croatia, Slovenia, Bosnia & Herzegovina, Albania and Macedonia. For the item 'Research policy experience', experts had to indicate how many years they had been involved in research policy, while for the item 'Degree' they had to indicate the highest degree earned. Finally, experts were asked to declare how experienced they are in RI ranging from 'Not experienced at all' to 'Extremely experienced'. *The incomplete responses from Round 1 were excluded from any analyses, since less than 50% of the survey had been completed by these respondents. The incomplete responses from Round 2 were included in the analysis.*

2.4.2 Delphi process

2.4.2.1. Round 1

In Round 1, we presented 14 and 11 topics to the RPO and RFO experts, respectively. Figures 2 and 3 show the percentage of experts who rated each topic as very important-absolutely essential. Consensus was reached on the importance of all topics in the RFO study and all but two topics in the RPO study ('Relationship between RPOs and RFOs' and 'Societal involvement in research'). Due to a lack of consensus on its importance and the argument that it is RFOs who should set requirements that RPOs should meet, we decided to exclude the topic 'Relationship between RPOs and RFOs'. Furthermore, not only was there no consensus reached on the topic 'Societal involvement in research', but experts also expressed concern that the topic was too discipline specific and controversial. Therefore, we also excluded this topic. Most of the topics also included a proposal for subtopics; the subtopics, along with the level of agreement for the topics and subtopics can be found in Tables 1 and 2 in Appendix 1.

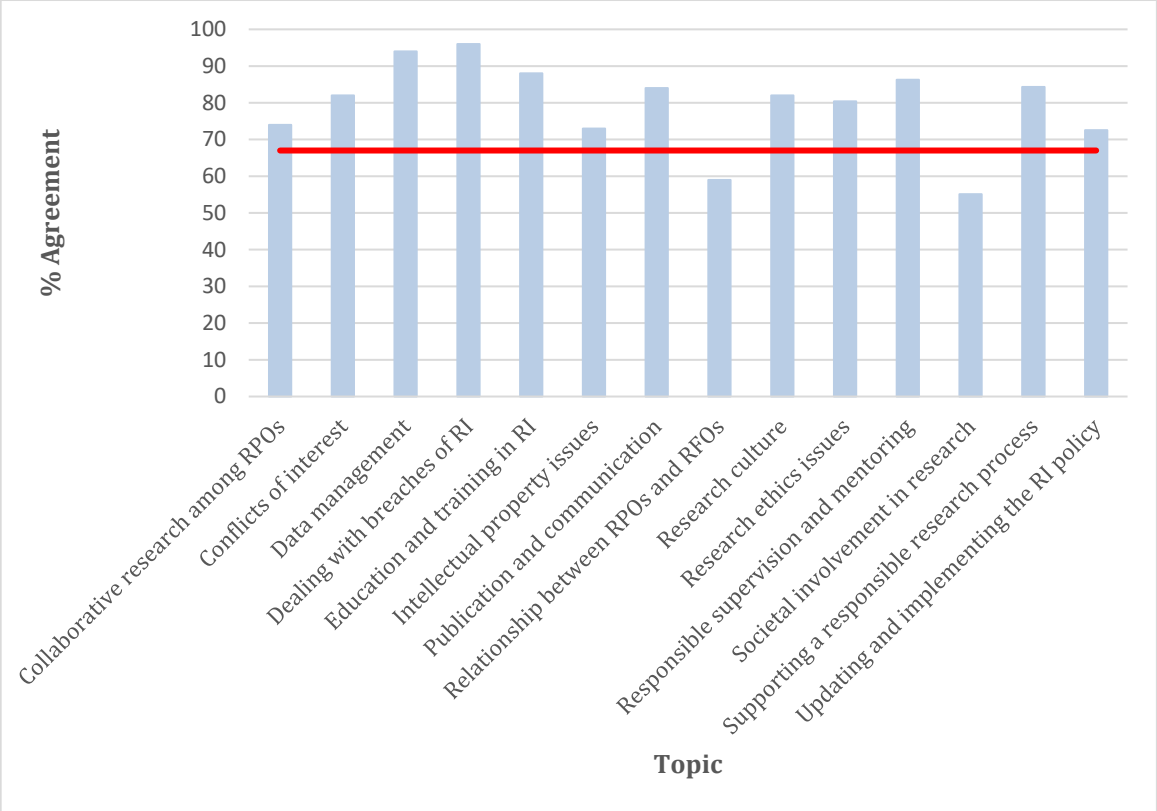

Figure 2 Experts' ratings of the importance of RI topics in the RPO study

The y-axis represents the percentage of experts who gave each topic a rating of 4-5 (very-extremely important). The red horizontal line represents the threshold we chose for consensus (67% agreement).

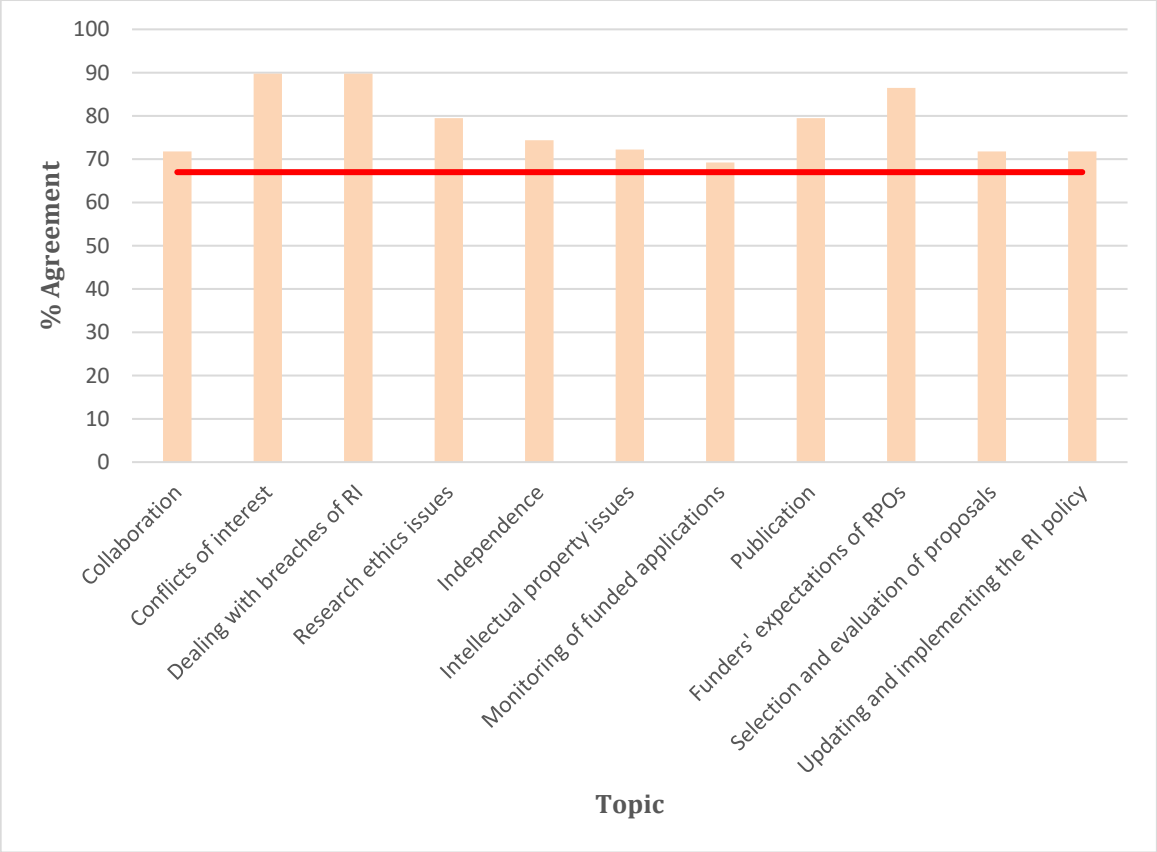

Figure 3 Experts' ratings of the importance of RI topics in the RFO study

The y-axis represents the percentage of experts who gave each topic a rating of 4-5 (very-extremely important). The red horizontal line represents the threshold we chose for consensus (67% agreement).

In the RPO study, consensus was reached for including all subtopics. However, based on the experts' comments and suggestions for new topics, we added 16 new subtopics, refined/clarified 3 existing subtopics, and moved 1 subtopic to a different heading. More details on this can be found in the executive summary of Round 1: https://osf.io/ga9q5/.

In the RFO study, consensus was reached for including all but 4 subtopics, of which we excluded 2, proposed to move 1 to a different topic and clarified 1. Additionally, based on the experts' comments, we added 6 new subtopics, excluded 1 existing topic and

refined/clarified 2 existing subtopics. A detailed explanation of these decisions can be found in the executive summary of Round 1: https://osf.io/93bn8/.

2.4.2.2. Round 2

Response to excluding topics from the RPO study

We informed experts in Round 2 of the RPO study that we would exclude the topics 'Relationship between RPOs and RFOs' and 'Societal involvement in research' from the SOPs4RI toolbox. Two experts objected to excluding 'Relationship between RPOs and RFOs' on the grounds that it is important to not absolve funders of their RI responsibilities, since funders are responsible for a range of incentives that influence RI. Additionally, these experts stated that RPOs and RFOs need to collaborate together to improve RI. We decided to exclude this topic from the RPO study nonetheless, considering that we are also addressing RFO's responsibilities in the SOPs4RI toolbox. Additionally, two experts objected to excluding the topic 'Societal involvement in research' from the toolbox based on the argument that the topic is important for wider transparency around research. Since we address transparency elsewhere in the toolbox (e.g. the subtopic 'communicating with the public'), we exclude this issue as a topic on its own.

Rating of subtopics

Consensus was reached for all 15 subtopic proposals in Round 2 for RPOs, except for the subtopic 'legal counselling' (51% agreement), which we decided to exclude from the topic 'Intellectual property issues' (Table 1 in Appendix 2). For the RFOs, consensus was also reached for 8 out of 10 proposals (Table 2 in Appendix 2). Consensus was not achieved for the subtopics 'establishing need for research' under the topic 'Selection and evaluation of proposals' based on the argument that this may not apply to all types of research, and would be difficult to implement. Therefore, we excluded the subtopic. Although consensus was not reached on including the subtopic 'diversity issues' under the topic 'Selection and

evaluation of proposals', 83% of respondents agreed that the subtopic should be included somewhere in the toolbox. Therefore, we included the subtopic under 'Selection and evaluation of proposals' as there was more agreement (53%) to include 'diversity issues' there, than under the topic 'Research ethics issues' where we had originally placed it in Round 1 (31%).

Ranking of topics

In the RPO study, experts prioritised the topics 'Education and training in RI', 'Responsible supervision and mentoring', 'Dealing with breaches of RI', 'Research ethics issues', 'Data management', 'Supporting a responsible research process', and 'Conflicts of interest' most frequently (Figure 4). In the RFO study, the topics most frequently prioritised were 'Dealing with breaches of RI', 'Conflicts of interest', 'Research ethics issues', 'Funders' expectations of RPO' and 'Selection and evaluation of proposals' (Figure 5).

In addition to selecting which topics to prioritise, experts had to rank their selected topics from 1-6 (RPOs) or 1-5 (RFOs), with 1 indicating highest priority and 6/5 indicating lowest. Figures 6 and 7 show the sum of the rankings across each topic; topics with lower scores represent a higher ranking. For the RPOs, in addition to the topics prioritised most frequently (Figure 4), 'Research culture' received a high ranking. This is most likely due to the high number of experts who ranked the topic first in terms of priority (16/49), even though less than 50% of the experts chose to prioritise the topic (Table 1, Appendix 3). Based on the results from the prioritisation of topics and the subtopic changes, we made a final list of ranked topics (including subtopics) for RPOs and RFOs, as can be found in Appendix 4 and 5.

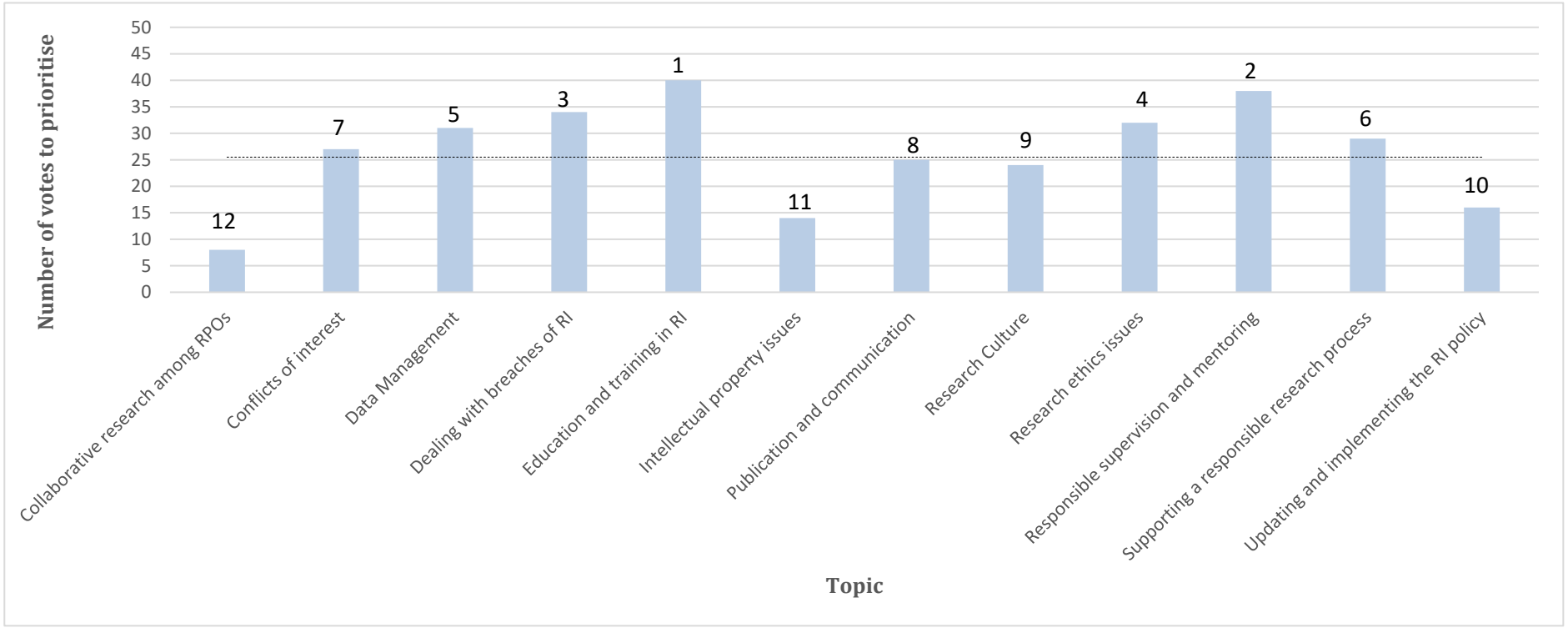

Figure 4 Prioritisation of topics in the RPO study

The y-axis represents the number of experts who prioritised each topic. The black dotted horizontal line represents 50% of the experts who completed this exercise. Based on the number of experts who prioritised each topic, the number on top of each bar represents the rank that each topic receives.

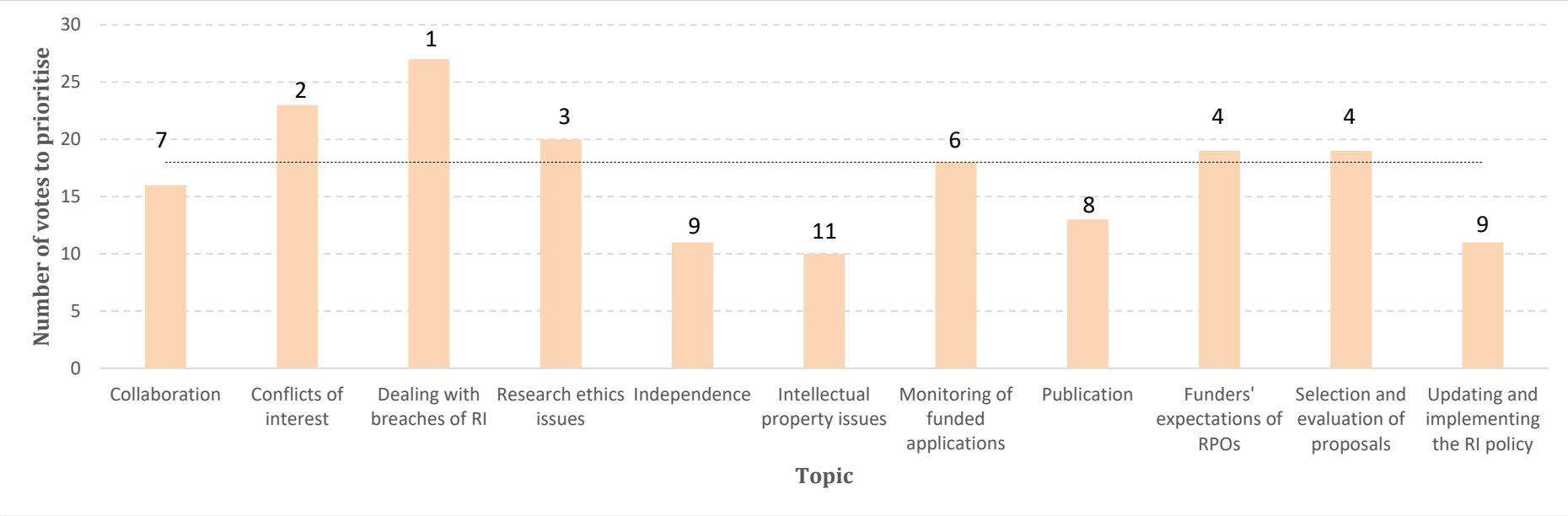

Figure 5 Prioritisation of topics in the RFO study

The y-axis represents the number of experts who prioritised each topic. The black dotted horizontal line represents 50% of the experts who completed this exercise. Based on the number of experts who prioritised each topic, the number on top of each bar represents the rank that each topic receives.

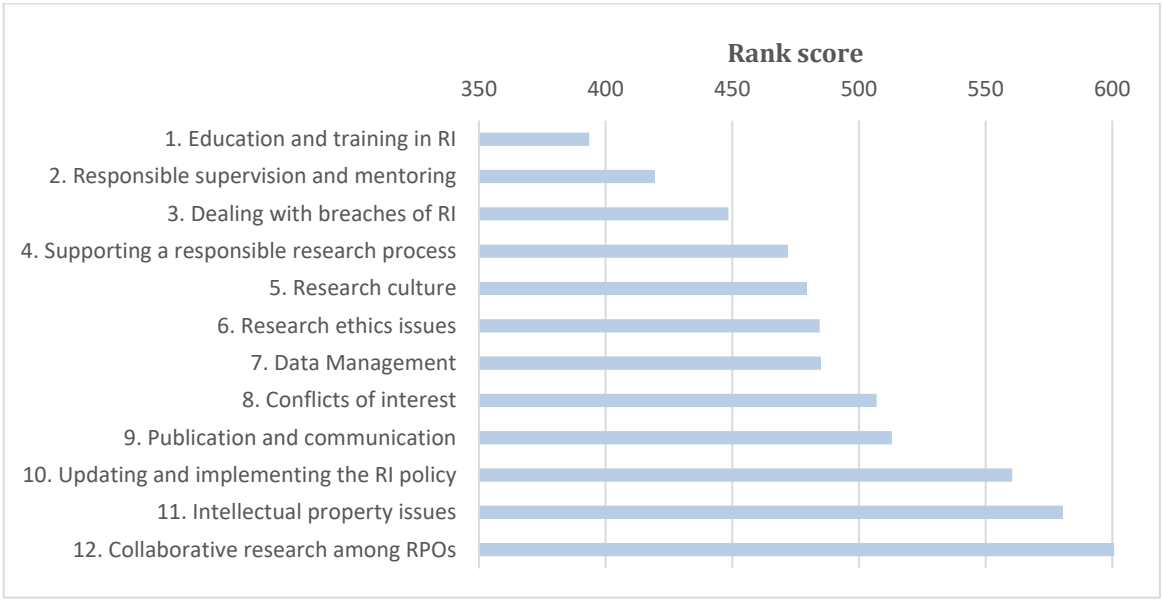

Figure 6 The ranking score of each topic in the RPO study

Topics with a lower rank score have indicate a higher rank

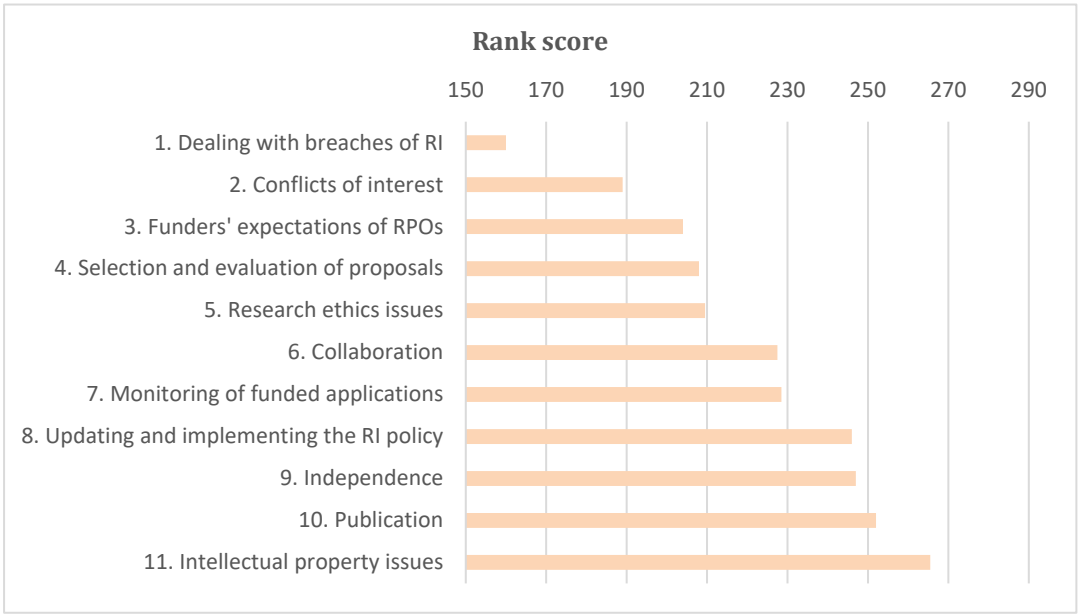

Figure 7 The ranking score of each topic in the RFO study

Topics with a lower rank score have indicate a higher rank.

2.4.3 Additional concerns identified

A thematic content analysis of the qualitative responses of the experts revealed some general concerns that experts have about potential challenges and opportunities for the creation and implementation of the SOPs4RI toolbox.

2.4.3.1. Opportunities versus risks offered by the toolbox

There was a mixed reaction to the intention to develop the SOPs4RI toolbox among both the RPO and RFO experts. Experts identified several risks to the project, including fears that:

- the toolbox would be intrusive;
- SOPs/guidelines might not capture the topics proposed well;
- SOPs/guidelines may not be effective in dealing with behavioural change;
- the SOPs4RI project may duplicate already existing resources and policies.

Appendix 6 has a list of resources that experts highlighted SOPs4RI should take into account when developing the RI toolbox.

On the other hand, experts also highlighted the direct opportunities provided by the SOPs4RI toolbox:

- it could lead to standardisation of policies across RPOs and RFOs;
- it could lead to clarity on, and a common understanding of, RI issues;
- it could help to build a comprehensive RI system (e.g. addressing both prevention and handling of research misconduct);
- it could raise awareness about RI;
- and that it could better define the roles and responsibilities of RPOs and RFOs regarding RI.

Additionally, experts stated that the toolbox could ultimately help to increase research quality, increase transparency, increase trust in science and reduce unconscious biases.

2.4.3.2. The definition of RI

When providing clarification for their ratings and rankings of topics and subtopics, experts often referred to the breadth of the definition of RI. More specifically, there were mixed opinions on whether topics that relate to research ethics, human resource management issues (e.g. assessment of researchers) and legal issues (e.g. intellectual property issues) fall under the scope of RI. Some experts advocated for using a broad definition of RI, so that any issues related to increasing trust in science or increasing reproducibility of studies would be included.

Arguments for employing the broad scope included that a wider definition helps to provide a more comprehensive overview at this early stage of the project, and that over time new integrity issues may emerge. Of note is that in some languages there is no specific word or concept for RI, which could make it difficult to define what a narrow scope of RI entails. Other experts were concerned that keeping the definition of RI broad would run the risk of including too many topics, as any issues that relate to 'good research' would be included under a broader definition. One expert argued that what matters is not whether the definition of RI used by SOPs4RI is broad or narrow, but that it is a definition that has agreement among the research community.

2.4.3.3. Type of guidance

The experts noted that it is important to consider in what form to provide guidance on the RI topics. They stated that there were two issues to consider when deciding on the form of guidance: 1) level of detail, and 2) prescriptiveness of guidance. We asked the experts to

rate whether we should produce SOPs or guidelines for the topics they prioritised to include in the SOPs4RI toolbox. Experts' preferences for SOPs or guidelines for the topics prioritised in Round 2 can be found in Figures 9 and 10. The preferences of the experts for all topics, including those that were less prioritised, can be found in appendix 7.

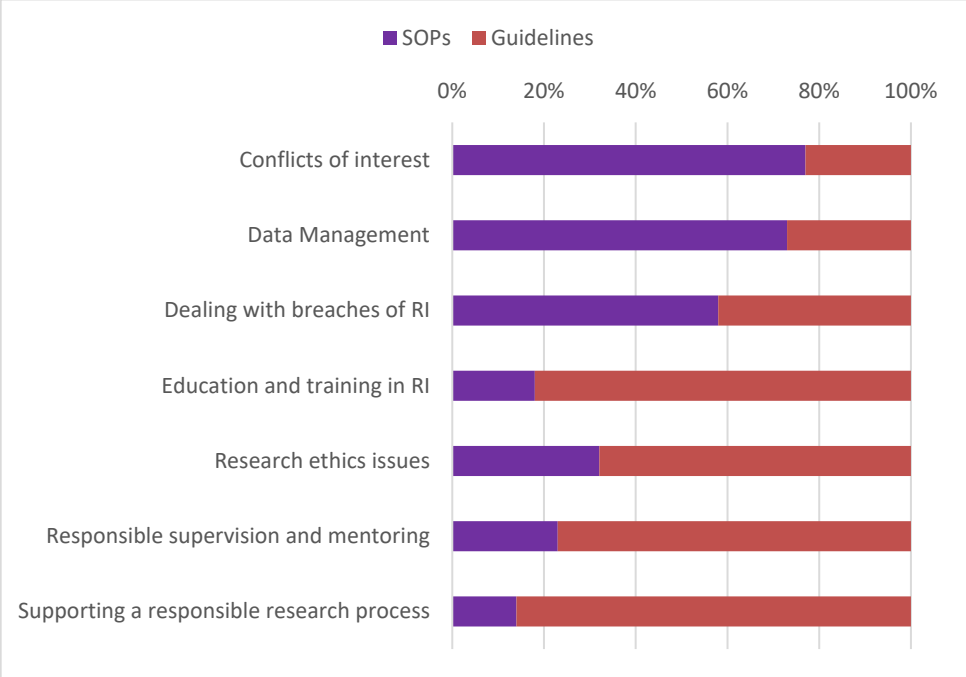

Figure 8 Preference for SOPs or guidelines in the RPO study

The figure only includes the responses for the topics most frequently prioritised.

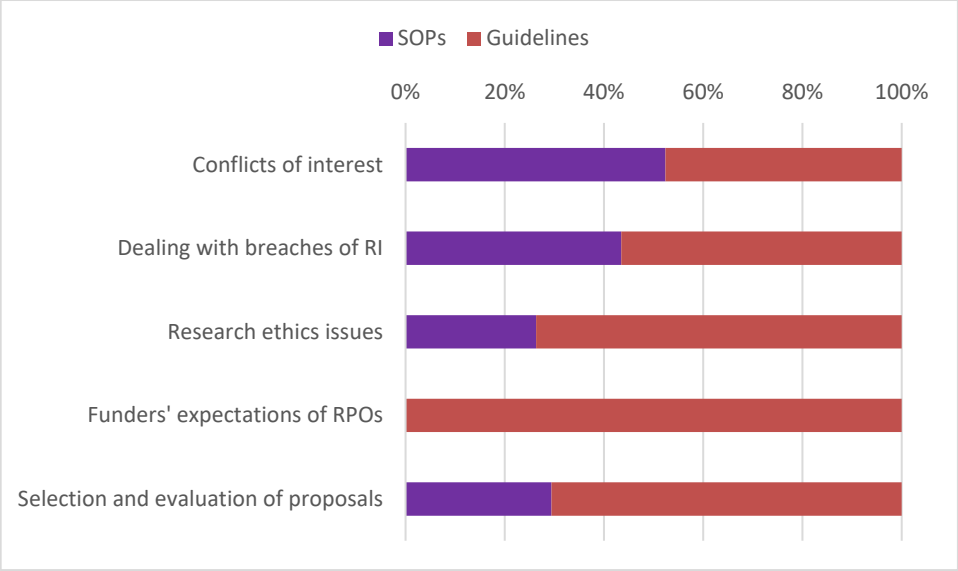

Figure 9 Preference for SOPs or guidelines in the RFO study

The figure only includes the responses for the topics most frequently prioritised.

Arguments for developing guidance on the topics in the form of SOPs were diverse. Respondents related SOPs to increasing objectivity, ensuring procedural fairness and equity, providing clarity, helping individuals better operationalise the guidance, depending less on individuals' moral capacities, and providing a concrete structure to the process at hand. Additionally, the experts argued that guidance for topics which are very important and/or sensitive and/or have more potential to cause problems will need a higher level of detail and prescriptiveness in order to be effective (i.e. the guidelines should be written as SOPs). In terms of feasibility, experts mentioned that the SOPs should be constructed so as to take into account differences among countries, institutions and research disciplines. One expert recommended different versions of the same SOP for different purposes (e.g. in data management, for different forms of data). Furthermore, the experts stated that SOPs are especially appropriate for topics that are related to legal and procedural issues.

However, legal and procedural issues were also pinpointed as being inappropriate for SOPs by some experts, who argued that differences in local laws and procedures make it difficult to develop SOPs that apply across all European contexts. Topics that were considered more "philosophical" and difficult in nature (e.g. research culture), as well as topics that dealt with human interaction (e.g. mentoring), were also thought to be better captured in guidelines. Other arguments for providing guidelines, rather than SOPs, included preference of scientists for general guidance, autonomy of organisations and researchers, differences across countries, variability in research venues, and differences in subject based approaches to RI. Some experts argued that for some topics, a combination of SOPs and guidelines might be optimal.

2.4.3.4. Differences among countries, disciplines and institutions

The experts stressed that the guidance SOPs4RI toolbox will provide to RPOs and RFOs should be sensitive to differences in countries, disciplines and institutions, in order to be useful. Experts' commented that providing a toolbox with different elements, which could be adapted and selected by different institutions (i.e. a modular approach) would help to take differences into account. However, the experts also stressed that there is a minimum that all institutions should agree on with regard to fostering RI, especially as some thought that differences among institutions are often exaggerated. Furthermore, it was acknowledged that the modular approach would only work if SOPs4RI also provides institutions with an implementation guide, including pointers on modifying the general toolbox for specific needs of the institutions.

2.4.3.5. Autonomy and responsibility

In the RFO study, experts raised the issue of autonomy. Researchers', RPOs' and RFOs' autonomy should not be impeded by the toolbox of SOPs4RI. However, they also stated that while autonomy is important, it is also crucial to agree on some minimum standards on central aspects of RI, for example, requirements and mechanisms that need to be established. Furthermore, the RFO experts stressed the importance of keeping in mind the differences in responsibility between RPOs and RFOs regarding RI, especially considering that RFOs have fewer resources to support researchers than RPOs.

2.5 Discussion

2.5.1 Findings

In the two Delphi studies presented here, we obtained consensus among experts in research policy on the importance of 12 topics for institutional efforts to foster RI in RPOs, and 11 topics for RFOs (Table 2). Among these topics, the RPO experts prioritised 7 topics and the RFO experts prioritised 5 topics as having the potential to have most impact on research practice (Table 2). For a description of each of the topics, you can click here for the RPO topics and here for the RFO topics.

Table 2: Highest ranked topics in the RPO and RFO studies

Rank	Topics	Organisation
1	Education and training in RI	
2	Responsible supervision and mentoring	
3	Dealing with breaches of RI	
4	Supporting a responsible research process	**RPOs**
5	Research ethics issues	
6	Data management	
7	Conflicts of interest	
1	Dealing with breaches of RI	**RFOs**

2	Conflicts of interest
3	Funders' expectations of RPOs
4	Selection & evaluation of proposals
5	Research ethics issues

While the topic 'Research culture' was not among the top RPO topics prioritised, a significant number of the experts thought that it should be ranked as the top topic, in terms of priority. This discrepancy can be explained by considering that the topics in our list are related and might have an impact on each other. More specifically, the most highly prioritised were on education and supervision, which are both thought to have a direct impact on research culture (19, 20). It could be that education and supervision are considered concrete ways that affect research culture, driving experts who deemed research culture as crucial to select them. Other issues of research culture (e.g. culture building, managing publication pressure, etc.) may have appeared vaguer to the experts, making it difficult to contemplate how SOPs or guidelines could help there in fostering a responsible research culture.

Along similar lines, it could be that dealing with breaches of RI was prioritised by both RFOs and RPOs, not only because of its role in tackling research misconduct, but also because it is a very concrete, legalistic and a procedural issue for which it is relatively straightforward to create SOPs or guidelines. In fact, as the experts pointed out, there are already excellent existing SOPs and guidelines on this topic (21). In terms of impact, it could be argued that while dealing with misconduct is important, there are other more important and effective ways to influence how research is conducted at an organisational level (8). Most of the problems with RI are not considered research misconduct and qualify as questionable research practices (QRPs) – a grey zone that in most instances would not be covered under the topic of misconduct (22). Since QRPs are more prevalent than research

misconduct, it seems that to foster RI effectively, it will be necessary to focus more on a positive approach of promoting and supporting responsible conduct of research (RCR), rather than on only identifying and punishing misconduct (8).

As with dealing with breaches of RI, it is likely that 'Research ethics issues' and 'Conflicts of interest' were also highly ranked in both studies due to the concrete nature of these topics. While research ethics may seem like a broad and vague concept, it has been addressed in the research community for much longer than other RI topics (23, 24). Additionally, there are already many research ethics governance frameworks across the globe. These governance frameworks focus on the procedures and processes with which researchers, RPOs and others must comply to abide by research ethics standards (25, 26). However, while ethics regulation of research is well established in biomedicine, other disciplines are less bound to strict ethical regulations. This could be related to the different nature of research conducted in other disciplines (e.g. in the humanities) (27). It is likely that our experts gave a high ranking to this topic due to the existing evidence that it is possible to create effective SOPs and guidelines, perhaps also for topics outside biomedicine.

The differences in the rest of the prioritised topics between the RPO and RFO study confirm our views that RPOs and RFOs have different roles and responsibilities in terms of fostering RI. Since researchers work in RPOs, they are highly dependent on the infrastructures and policies of RPOs. RPOs are therefore responsible for creating the necessary systems and structures to support researchers in doing responsible research, including the provision of RI training, having responsible supervision processes and providing the necessary infrastructures for good data management (as not all institutions in the EU already have a firm data management support system (28)).

Alternatively, RFOs are less regularly directly involved with researchers. Hence, RFOs rely on RPOs for many aspects of RI promotion (e.g. the provision of appropriate data management infrastructure, training, etc.). RFOs can create the incentives (i.e. funding) to demand that RPOs and researchers take their RI responsibilities seriously (e.g. regarding methods, open science practices, open access publications), so they can set clear expectations for RPOs and researchers (4, 29). In addition, they should have mechanisms in place to take action against RPOs that do not deal with RI issues appropriately (e.g. by imposing sanctions on RPOs). However, RI violations could also happen at the RFO internally (e.g. conflicts of interest between reviewers and applicants). RFOs should also ensure that they have the necessary mechanisms to detect conflicts of interests and breaches of RI within their organisation.

The topic 'Updating and implementing the organisational RI policy' was low on the priority list in both the RPO and RFO studies. This might seem surprising, considering that experts acknowledged that SOPs4RI's modular toolbox (i.e. where institutions can adapt and change the different elements in the toolbox) will only work if we also provide guidance to institutions on how to use, implement, update and adapt the toolbox. However, it might be that experts did not prioritise this topic because its content is more instrumental to the SOPs4RI toolbox, rather than conceptually related to RI. In fact, there is little mention in the RI literature on this topic. Therefore, it might be that it is urgent to address this topic in the SOPs4RI project practically, despite the experts' prioritisation, which was more focused on theoretical RI considerations.

2.5.2. Limitations and strengths

While we obtained a sufficient number of responses to have an acceptable level of representation of experts from different countries and institutions across Europe, the

response rate for both Delphi studies (12-18%) was lower than reported in other Delphi studies (e.g. 70% in 30, 31). A low response rate could be deemed problematic in Delphi studies, as it could be an indication that experts do not find the study important (18). Taking into consideration that our target group included rectors, deans, funding heads, etc., we expected that many experts would be too busy to participate in the study, rather than not find the study important. Indeed, of the few experts' who informed us that they would not participate, they mentioned lack of time and conflicting duties as their main reason for not participating.

Additionally, it is not known whether response rates in Delphi studies are directly related to the reliability of results. Since the Delphi method is qualitative in nature, the quality of the input from the experts, rather than the quantity (i.e. response rate) is important. On the other hand, missing important perspectives (e.g. from different countries) could be said to bias the results. Considering that our experts represented a variety of disciplinary fields and countries, we do not think that this was of great concern in our Delphi studies. Nevertheless, we will also delve into the literature and interview studies of WP3 of SOPs4RI to supplement the topics from the Delphi, in order to ensure that we do not miss any other important topics not mentioned by the Delphi experts. It is unclear whether Delphi studies that report higher response rates do so on the basis of all experts that are approached to join the study or only on the number of experts who already declare interest in the study before receiving the official study invite (18). If the responses rates are based on the latter, it is natural that our response rate is much lower as we sent the study invites to most of the experts directly, rather than informing them about the study beforehand.

Another methodological concern in this study was the consensus threshold value of 67%. We chose this threshold based on the idea that obtaining consensus on 2/3 of the

experts would be sufficient to make a well-informed consensus assessment about a specific topic or subtopic. However, this cut-off – like all cut-offs in Delphi studies – was arbitrary (32). In the Delphi literature, there are no set standards about how to measure consensus, nor on what threshold value to choose (32). Therefore, in addition to examining the level of agreement for the inclusion of a topic or subtopic, we also relied heavily on the qualitative arguments that the experts provided. This gave us an additional means to check whether including or excluding a topic/subtopic was in line with the expert panels' ideas.

Considering that the studies reached out to a heterogenous expert panel consisting of more than 100 experts, representing different countries (37), genders, and disciplines, we were quite successful in engaging with the potential users of the SOPs4RI toolbox (i.e. research policy makers) at an early stage of the project. Furthermore, by employing the Delphi method, we were able to systematically and democratically engage with the experts (15). Additionally, since the experts' identities remained anonymous to the other experts' and researchers (except for K.L. and J.T), we were able to reduce biases that might occur should the participants know each other (e.g. higher status stakeholders dominating the discussion) (15).

2.5.3. Conclusion and recommendations

As can be seen in Table 2, the findings of the two Delphi studies reported here indicate that in order to foster RI, RPOs and RFOs need to have stringent procedures in place to handle breaches of RI and conflicts of interest. Additionally, both organisation types should have policies on research ethics issues. However, there are also differences in the responsibilities of RPOs and RFOs in promoting RI. RPOs should especially focus on providing support to researchers in conducting research responsibly (e.g., providing quality assurance support through monitoring policies), education and training in RI, improving supervision and

mentoring, and informing about good data management as well as providing good data management infrastructure. Alternatively, RFOs should clarify their expectations of RPOs regarding RI, as well as develop fair procedures, which will incentivise responsible research, to evaluate and select proposals for funding. To address these issues, RPOs and RFOs are in need of operational guidance, in the form of SOPs and guidelines. Over the next 3.5 years, SOPs4RI will investigate empirical considerations to provide effective evidence-based guidance for RI to both organisation types.

4. Appendix 1: Ratings of topics and subtopics in Round 1

Table 1: Agreement among experts on importance of topics/subtopics in the RPO study

Topics & subtopics	Agreement
1. Collaborative research among RPOs	**38/51 (75%)**
a. within/outside the EU	42/49 (86%)
b. between countries with different R&D infrastructures	39/49 (80%)
c. between public and private RPOs	45/51 (88%)
2. Conflicts of interest	**42/51 (82%)**
a. What constitutes a conflict of interest?	43/49 (88%)
b. Handling conflicts of interest	47/50 (94%)
3. Data management	**48/51 (94%)**
a. Data protection and privacy	46/51 (90%)
b. Secure data storage infrastructure	43/51 (84%)
c. FAIR principles	46/50 (92%)
4. Dealing with breaches of RI	**49/51 (96%)**
a. RI bodies	45/51 (88%)
b. Protection of whistleblowers	44/49 (90%)
c. Protection of those accused of research misconduct	47/49 (96%)
d. Procedures for investigating allegations of misconduct	48/51 (94%)
e. Sanctions	36/50 (72%)
f. Other actions in case of misconduct	43/49 (88%)
5. Education and training in RI	**45/51 (88%)**
a. Pre-doctorate RI trainings	45/51 (88%)
b. Post-doctorate RI trainings	44/50 (88%)
c. Training of RI personnel and teachers	48/51 (94%)
d. RI counselling and advice	45/51 (88%)
6. Intellectual property issues	**37/51 (73%)**
7. Publication and communication	**43/51 (84%)**
a. Publication statement	39/47 (83%)
b. Authorship	48/50 (96%)
c. Open science	41/50 (82%)
4. The use of reporting guidelines	39/48 (81%)
8. Relationship between RPOs and RFOs	**30/51 (59%)**
9. Research culture	**42/51 (82%)**
a. Fair procedures for appointments, promotions and remuneration	41/49 (84%)
b. Career support	34/48 (71%)
c. Culture building	39/51 (76%)

d. Managing competition and publication pressure	39/50 (78%)
e. Conflict management	44/51 (86%)
10. Research ethics issues	**41/51 (80%)**
a. Set-up and tasks of ethics committees	39/49 (80%)
b. Ethics review procedures	44/49 (90%)
c. Diversity issues	33/46 (72%)
11. Responsible supervision and mentoring	**44/51 (86%)**
a. PhD guidelines	42/50 (84%)
b. Supervision requirements and guidelines	46/51 (90%)
c. Supervision by managers/department heads	36/50 (72%)
12. Societal involvement in research	**27/49 (55%)**
a. Communicating with lay audience/stakeholders	36/50 (72%)
b. Inclusion of stakeholders in the conduct of research	26/48 (54%)
c. Interaction with public authorities/policies makers	32/48 (67%)
13. Supporting a responsible research process	**43/51 (84%)**
a. Research requirements	44/51 (86%)
b. Transparency	42/49 (86%)
c. Quality assurance	38/48 (79%)
14. Updating and implementing the RI policy	**37/51 (73%)**

Table 2: Agreement among experts on importance of topics/subtopics in the RPO study

Topic	Agreement
1. Collaboration	**28/39 (72%)**
a. Expectations on collaborative research	32/38 (84%)
b. Handling conflicts between grant co-applicants	28/39 (72%)
c. Handling RI conflicts within the funding agency	24/38 (63%)
d. Handling RI conflicts between the funder and grant applicant	29/39 (74%)
2. Conflicts of interest	**35/39 (90%)**
a. Among review committee members	36/39 (92%)
b. Among reviewers	35/39 (90%)
c. Among staff members	31/38 (82%)
3. Dealing with breaches of RI	**35/39 (90%)**
a. RI bodies	30/38 (79%)
b. Breaches by funded researchers	36/39 (92%)
c. Breaches by review committee members	36/39 (92%)
d. Breaches by reviewers	37/39 (95%)
e. Breaches by staff members	32/38 (84%)

f. Protection of whistleblowers and those accused of research misconduct	31/39 (79%)
4. Funders' expectations of RPOs	**32/37 (86%)**
5. Independence	**29/39 (74%)**
a. Preventing unjustifiable interference by the funding agency	32/38 (84%)
b. Preventing unjustifiable interference by political or other external influences	28/35 (80%)
c. Preventing unjustifiable interference by commercial influences	30/35 (86%)
6. Intellectual property issues	**26/36 (72%)**
7. Monitoring of funded applications	**27/39 (69%)**
a. Financial monitoring	24/36 (67%)
b. Monitoring of the execution of the research grant	29/37 (78%)
c. Monitoring of compliance with RI requirements	30/36 (83%)
8. Publication	**31/39 (79%)**
a. Publication requirements	33/36 (92%)
b. Expectations on authorship	34/38 (89%)
c. Open science	33/38 (87%)
9. Research ethics issues	**31/39 (79%)**
a. Research ethics requirements	33/38 (87%)
b. Diversity issues	25/38 (66%)
c. Ethics reporting requirements	30/37 (81%)
10. Selection and evaluation of proposals	**28/39 (72%)**
a. RI plan	29/39 (74%)
b. Establishing need for research	20/34 (59%)
c. Methodological requirements	28/35 (80%)
d. Plagiarism	31/39 (79%)
11. Updating and implementing the RI policy	**28/39 (72%)**

5. Appendix 2: Ratings of subtopics in Round 2

Table 1: Agreement among experts on our subtopic proposals in Round 1 of the RPO study

Topic	Subtopic	Agreement on proposals
Conflicts of interest	In peer review	47/49 (96%)
	In the conduct of research	40/49 (82%)
	In appointments and promotions	40/49 (82%)
	In research evaluations	47/49 (96%)
	In consultancy	37/49 (76%)
Dealing with breaches of RI	Sanctions	36/49 (73%)
Intellectual property issues	Policies ensuring compliance with IP regulations	38/49 (78%)
	Interaction of IP and open science requirements	40/49 (82%)
	Legal counselling	25/49 (51%)
Publication & Communication	Peer review	46/49 (94%)
	Predatory publishing	43/49 (88%)
	Communicating with the public	40/49 (82%)
Research culture	Adequate education & skills training	41/49 (84%)
	Diversity issues*	37/49 (76%)
Supervision and mentoring	Building and leading an effective team	38/49 (78%)

**Experts rated whether to include 'Diversity issues' under the topic 'Research culture' (in line with our proposal) or 'Research ethics issues'. For the rest of the subtopics, experts rated whether to include (in line with our proposals) or exclude the subtopics.*

Table 2: Agreement among experts on our subtopic proposals in Round 1 of the RFO study

Topic	Subtopic	Agreement on proposals
Collaboration	Handling conflicts between grant co-applicants*	27/36 (75%)
	Research that is co-financed by multiple funders	34/36 (94%)
Independence	What counts as an unjustifiable interference?	30/36 (83%)
Monitoring	Financial monitoring	24/36 (67%)
Funders' expectations of RPOs	Codes of Conduct	31/36 (86%)
	Assessment of researchers	27/36 (75%)
	Education and training for RI	30/36 (83%)
	Processes for investigating allegations of research misconduct	35/36 (97%)
Selection and evaluation of proposals	Diversity issues**	19/36 (53%)
	Establishing need for research	23/36 (64%)

**We proposed to exclude the topic 'Handling conflicts between grant co-applicants', and experts could rate whether to exclude it or include it. ** Experts could rate whether to include 'Diversity issues' under the topic 'Selection and evaluation of proposals' (in line with our proposals), under 'Research ethics issues', or to exclude it from the toolbox. For the rest of the subtopics, experts rated whether to include (in line with our proposals) or exclude the subtopics.*

6. Appendix 3: Ranks per topic

Table 1: Ranking the topics prioritised by experts in the RPO study

Topic	Rank					
	1	**2**	**3**	**4**	**5**	**6**
Collaborative research among RPOs	1	0	1	2	1	3
Conflicts of interest	3	3	3	5	8	5
Data Management	1	7	4	7	3	9
Dealing with breaches of RI	4	8	8	4	4	6
Education and training in RI	9	8	9	7	4	3
Intellectual property issues	0	3	3	1	3	4
Publication and communication	4	4	2	4	5	6
Research culture	16	1	1	2	1	3
Research ethics issues	5	1	3	6	9	8
Responsible supervision and mentoring	2	10	11	6	8	1
Supporting a responsible research process	7	5	4	5	5	3
Updating and implementing the RI policy	1	3	4	4	2	2

Experts could rank each topic they prioritised (each expert picked 6 from the list) between 1 and 6, with 1 indicating the highest priority. The numbers on the right, under each rank, show the number of experts who allocated that specific rank to each topic.

Table 2: Ranking the topics prioritised by experts in the RFO study

Topic	Rank				
	1	**2**	**3**	**4**	**5**
Collaboration	3	4	2	3	4
Conflicts of interest	4	6	3	5	5
Dealing with breaches of RI	6	8	6	1	5
Research ethics issues	3	3	4	6	4
Independence	4	3	2	0	2
Intellectual property issues	0	1	3	5	1
Monitoring of funded applications	1	1	5	7	3
Publication	1	2	2	3	5
Funders' expectations of RPOs	5	5	2	5	2
Selection and evaluation of proposals	5	2	6	2	4
Updating and implementing the RI policy	5	2	2	0	2

Experts could rank each topic they prioritised (each expert picked 5 from the list) between 1 and 5, with 1 indicating the highest priority. The numbers on the right, under each rank, show the number of experts who allocated that specific rank to each topic.

7. Appendix 4: Prioritised list of RI topics for RPOs

Rank	Topic	Subtopics
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 and mentoring	a. PhD guidelines b. supervision requirements & guidelines c. building and leading an effective team
3	Dealing with breaches of RI	a. RI bodies in the organisation b. protection of whistleblowers c. protection of those accused of misconduct d. procedures for investigating allegations e. sanctions f. other actions
4	Supporting a responsible research process	a. research requirements b. transparency c. quality assurance
5	Research ethics issues	a. set-up and tasks of ethics committees b. ethics review procedures
6	Data management	a. guidance and support b. secure data storage infrastructure c. FAIR principles
7	Conflicts of interest	a. in peer review b. in the conduct of research c. in appointments and promotions d. in research evaluations e. in consultancy
8	Research culture	a. fair procedures for appointments, promotions and remuneration b. adequate education and skills training c. culture building d. managing competition & publication pressure e. conflict management f. diversity issues
9	Publication and communication	a. publication statement

		b. authorship c. open science d. use of reporting guidelines e. peer review f. predatory publishing g. communicating with the public
10	Updating and implementing the RI policy	*NONE*
11	Intellectual property issues	a. policies ensuring compliance with IP regulations b. interaction of IP and open science requirements
12	Collaborative research among RPOs	a. among RPOs inside/outside the EU b. with countries with different R&D infrastructures c. between public and private RPOs

8. Appendix 5: Prioritised list of RI topics for RFOs

Rank	Topic	Subtopic
1	Dealing with breaches of RI	a. RI bodies in the organisation b. by funded researchers c. by review committee members d. by reviewers e. by staff members f. protection of whistleblowers and the accused
2	Conflicts of interest	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 issues	a. research ethics requirements b. ethics reporting requirements
6	Collaboration	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
8	Updating and implementing the RI policy	*NONE*
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	a. publication requirements

		b. expectations on authorship c. open science
11	Intellectual property issues	*NONE*

9. Appendix 6: Existing resources

Source	Resources	Link	RPO or RFO study?
ALLEA	The European Code of Conduct for Research Integrity	https://ec.europa.eu/research/participants/data/ref/h2020/other/hi/h2020-ethics_code-of-conduct_en.pdf	Both
ALLEA	Institutional dealing with scientific misconduct	http://eruditio.worldacademy.org/files/issue-6/reprints/ej-v1-i6-institutional-dealing-pdrenth-reprint.pdf	RPO
ALLEA	Research Integrity and Research Ethics	https://allea.org/research-integrity-and-research-ethics/	RPO
Canada	Policies on dealing with allegations of misconduct	http://www.nserc-crsng.gc.ca/_doc/NSERC-CRSNG/HAL_Report_e.pdf	RFO
COLCIENCIAS	Documento de Política Nacionalde Ciencia, Tecnología e Innovación	https://www.colciencias.gov.co/sites/default/files/pdf_poltica.pdf	RFO

COPE	Various guidelines	https://publicationethics.org/guidance/Guidelines	RFO
CSIC Spain	Various guidelines/codes	https://www.csic.es/en/csic/scientific-integrity-and-ethics-csic/scientific-integrity-and-good-practises	RPO
DFG	Guidelines for Safeguarding Good Scientific Practice	https://www.dfg.de/en/research_funding/principles_dfg_funding/good_scientific_practice/index.html	RFO
Digital Curation Centre	Various resources on data management	http://www.dcc.ac.uk/	RPO
DMPonline	Various resources on data management	https://dmponline.dcc.ac.uk/	RPO
DORA	San Fransisco Declaration on Researcher Assessment	https://sfdora.org/read/	RFO
EMBO	Various resourcse	https://www.embo.org/science-policy/research-integrity/resources-on-research-integrity	RPO
ENERI	List of training options	http://eneri.eu/online-available-training-options-for-recs-and-rios/	RPO
ENRIO	Recommendations for the investigation of research misconduct	http://www.enrio.eu/wp-content/uploads/2019/03/INV-Handbook_ENRIO_web_final.pdf	Both
Epigeum	Training materials	https://www.epigeum.com/courses/research/research-integrity/	RPO
ERC	Various policies	https://erc.europa.eu/erc-standing-committees/conflict-interests-scientific-misconduct-and-ethical-issues	RFO

European Commission	Research Ethics	https://ec.europa.eu/research/swafs/index.cfm?pg=policy&lib=ethics	RPO
European Commission	Guidance note — Research on refugees, asylum seekers & migrants	https://ec.europa.eu/research/participants/data/ref/h2020/other/hi/guide_research-refugees-migrants_en.pdf	RPO
European Commission	Ethics in Social Science and Humanities	https://ec.europa.eu/research/participants/data/ref/h2020/other/hi/h2020_ethics-soc-science-humanities_en.pdf	RPO
European Commission	How to complete your ethics self-assessment	https://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/ethics/h2020_hi_ethics-self-assess_en.pdf	RPO
Hugh Kearns	Books and other various resources	https://www.flinders.edu.au/people/hugh.kearns	RPO
InterAcademy Partnership	Responsible Conduct in the Global Research Enterprise	https://www.interacademies.org/33362/Responsible-Conduct-in-the-Global-Research-Enterprise	RPO
InterAcademy Partnership	Doing Global Science: A Guide to Responsible Conduct in the Global Research Enterprise	https://www.interacademies.org/33345/Doing-Global-Science-A-Guide-to-Responsible-Conduct-in-the-Global-Research-Enterprise	Both

Ireland	Ensuring Research Integrity in Ireland	https://www.iua.ie/publication/view/national-policy-statement-on-ensuring-research-integrity-in-ireland/	RFO
Irish National Research Integrity Forum	Various resources	https://www.iua.ie/for-researchers/research-integrity/	RFO
KNAW Netherlands	Scientific Research: Dilemmas and Temptations	https://www.knaw.nl/shared/resources/actueel/publicaties/pdf/knawdilemmasandtemptations.pdf	RPO
National Academies of Science	Open Science by Design	https://www.nap.edu/catalog/25116/open-science-by-design-realizing-a-vision-for-21st-century	RFO
National Academies of Science	Reproducibility and replicability in science	https://www.nap.edu/catalog/25303/reproducibility-and-replicability-in-science	RFO
National Academy of Sciences	On being a scientist	https://www.ncbi.nlm.nih.gov/pubmed/25009901	RPO
National Academy of Sciences	Fostering Integrity in Research	https://www.nap.edu/catalog/21896/fostering-integrity-in-research	RFO
NHMRC Australia	Different guidelines	https://www.nhmrc.gov.au/research-policy/research-integrity	RPO

NHMRC Australia	Guide to Managing and Investigating Potential Breaches of the Australian Code for the Responsible Conduct of Research	https://www.nhmrc.gov.au/sites/default/files/documents/reports/guide-managing-investigating-potential-breaches.pdf#targetText=Research%20Integrity%20Advisor%20(RIA)%20Person,potential%20breaches%20of%20the%20Code.	RPO
NIH	Various policies and resources	https://grants.nih.gov/policy/research_integrity/index.htm	RFO
Northwestern University	Various policies	https://www.researchintegrity.northwestern.edu/	RPO
NTU Singapore	NTU Research Data Policy	https://research.ntu.edu.sg/rieo/RI/Pages/Research-Data-Policies.aspx	RPO
Nuffield Council on Bioethics	The culture of research	http://nuffieldbioethics.org/project/research-culture	RPO
NWO	NWO Scientific Integrity Policy	https://www.nwo.nl/en/policies/scientific+integrity+policy	RFO
OEAWI	Training overview	https://oeawi.at/en/training-overview/	RPO
ORI	The Lab	https://ori.hhs.gov/the-lab	RPO
ORI	Various resources	https://ori.hhs.gov/	Both
PRINTEGER	Working with Research Integrity—Guidance	https://link.springer.com/article/10.1007/s11948-018-0034-4	RPO

	for Research Performing Organisations: The Bonn PRINTEGER Statement		
RRI tools	Various resources	https://www.rri-tools.eu/	RPO
SATORI	Various resources	http://satoriproject.eu/external-resources/	RPO
Science Europe	Research integrity—what it means, why it is important and how we might protect it	https://phys.org/news/2015-12-integritywhat-important.html	RPO
Science Foundation Ireland	Various assurance processes	http://www.sfi.ie/funding/sfi-policies-and-guidance/integrity/	RFO
Standford University	Various resources	https://doresearch.stanford.edu/research-scholarship/responsible-conduct-research	RPO
The Embassy of Good Science	Various resources	https://www.embassy.science/resources	RPO
UK RIO	Various resources	https://ukrio.org/research-integrity-resources/	RPO
UK Royal Society	Research culture	https://royalsociety.org/topics-policy/projects/research-culture/	RPO

UKRI	Funding Assurance Program	https://www.ukri.org/about-us/policies-and-standards/funding-assurance-programme/	RFO
UNESCO	Recommendations for science and scientific researchers	https://en.unesco.org/themes/ethics-science-and-technology/recommendation_science	RFO
University of Edinburgh	Research Data Management	https://www.ed.ac.uk/information-services/research-support/research-data-service	RPO
University of Music and Performing Arts Vienna	Various resources	https://www.mdw.ac.at/aki/	RPO
University of Pittsburgh	Research Data Management	https://pitt.libguides.com/managedata	RPO
VSNU	Netherlands Code of Conduct for Research Integrity	https://www.vsnu.nl/files/documents/Netherlands%20Code%20of%20Conduct%20for%20Research%20Integrity%202018.pdf	RFO
WCRI	The Hong Kong Principles	https://wcri2019.org/uploads/files/2019_new/Hong_Kong_Manifesto_0527.pdf	RFO
ZonMW	Strengthening Impact in the Netherlands	https://gallery.mailchimp.com/7fa42547078f2cac7d96896f5/files/54710d19-6a40-4f27-a8c9-c3a15a010a59/Wendy_paper.pdf	RFO

ZonMW	Codes on conflicts of interest	https://www.zonmw.nl/en/about-zonmw/integrity-and-conflicts-of-interest/	RFO

10. Appendix 7: Form of guidance – SOPs or guidelines

Table 1: Preference of the experts for SOPs or guidelines on the topics in the RPO study

Topics	SOPs	Guidelines
Collaborative research among RPOs	2	5
Conflicts of interest	20	6
Data Management	22	8
Dealing with breaches of RI	18	13
Education and training in RI	7	32
Intellectual property issues	8	5
Publication and communication	9	15
Research Culture	2	22
Research ethics issues	9	19
Responsible supervision and mentoring	8	27
Supporting a responsible research process	4	25
Updating and implementing the RI policy	4	10

The numbers indicate the numbers of experts who indicated a preference for SOPs and guidelines for each topic. Experts only had to indicate preference for topics they prioritised, which explains why there are more ratings for some topics than others.

Table 2: Preference of the experts for SOPs or guidelines on the topics in the RFO study

Topics	SOPs	Guidelines
Collaboration	6	9
Conflicts of interest	11	10
Dealing with breaches of RI	10	13
Research ethics issues	5	14
Independence	3	8
Intellectual property issues	3	6
Monitoring of funded applications	10	7
Publication	4	9
Funders' expectations of RPOs	0	16
Selection and evaluation of proposals	5	12
Updating and implementing the RI policy	1	8

The numbers indicate the numbers of experts who indicated a preference for SOPs and guidelines for each topic. Experts only had to indicate preference for topics they prioritised, which explains why there are more ratings for some topics than others.

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The project leading to this application has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824481.