



SOPs4RI

D4.3: Second version of SOPs and guidelines

Authors: I. Lechner, J. Tjldink, M.P. Sørensen, T. Ravn , A.-K. Bendtsen, K. Labib, W. Kaltenbrunner, A.E. Reyes Elizondo, P. Kavouras

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Authors:	Iris Lechner, Joeri Tjink, Mads P. Sørensen, Tine Ravn , Anna-Kathrine Bendtsen, Krishma Labib, Wolfgang Kaltenbrunner, Andrea E. Reyes Elizondo, Panagiotis Kavouras
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1. Introduction

1.1 Abbreviations

CoC – Code of Conduct

Col – Conflict of Interest

DMP – Data Management Plan

ECoC – European Code of Conduct

ERB – Ethical Review Board

FAIR Findable, Accesible, Interoperable, Reproducible

FG – Focus group

IRB – Institutional Review Board

QRP – Questionable Research Practices

R&D – Research and Development

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

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.

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 decisionmaking 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.

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.

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.) WP4 in this deliverable creates the second version of the toolbox (version 2.0). In the co-creation workshops with stakeholders this version will further be improved to version 3.0.

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. 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. The implementation of 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.

1.5 About this deliverable

Deliverable 4.3 provides the second version of the toolbox with SOPs and guidelines. The results from the focus group interviews are reviewed to account for disciplinary differences. Specific activities corresponding to this deliverable are consulting with SOPs and guideline experts, raising specific issues and deciding which subtopics should be discussed in the co-creation workshops, and performing a review round of discussion for the next version of the toolbox in collaboration with WP5. This is a back loop review to see whether the content is interpreted correctly. Deliverable 4.3 therefore sets the scene for other deliverables in WP4:

- D4.4 Report on the co-creation workshops (KUL, M28)
- D4.5 Third version of the SOPs and guidelines (VUmc, M26)
- D4.6 Fourth version of SOPs and guidelines (VUmc, M34)
- D4.7 Final toolbox with SOPs and guidelines (version 5.0) (VUmc, M48)



2. Second 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.

WP 4 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.

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 D4.3 are to develop the second version of the toolbox. This version of the toolbox integrates the knowledge gathered in different deliverables of the SOPs4RI project and mainly focuses on disciplinary differences that have been analysed in a number of focus groups in work package 5. It also examines the importance of several topics, related to the disciplinary differences. Moreover, this deliverable looks forward towards the co-creation workshops and present some preliminary work that has been done in preparation of the co-creation workshops, which will be conducted at the end of 2020.

2.3 Methodology towards the second version of the toolbox

2.3.1 Introduction

The second version of the toolbox builds on the first version 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 defined to be important for RPOs to develop RIIPs and 11 topics were defined to be important for RPOs. The second version of the toolbox presents 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.

2.3.2 Specific activities

The specific activities in WP4 for this deliverable are:

1. Integrate the knowledge output of the focus groups as provided by WP5 in D5.2 and incorporate these disciplinary differences in the next version of the toolbox. This is the key element of the work in deliverable 4.3
2. Develop a methodology to further develop recommendations and guidelines for underdeveloped topics
3. Prepare for the co-creation workshops
4. Support the development of the first online toolbox with SOPs and guidelines.

2.3.3 Methodological steps

The methodological steps correspond to the specific activities as provided above.

1: Integrate knowledge output of focus groups

- Highlight disciplinary differences

- Compare the key outcomes of the four disciplines; humanities, social sciences, natural sciences and medical sciences, per topic and subtopics for both RPOs and RFOs.
- Compare the key outcomes of these disciplinary differences with the first version of the toolbox
- Draw conclusions per (sub)topic on disciplinary differences and make sure these disciplinary differences are taken into account in the further development of the toolbox.

2: Concrete sets of recommendations (continuous work in WP4, will be ready by the end of 2020)

- 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 with experts
- Identify knowledge gaps per subtopic
- Find documents that may help covering these knowledge gap and draft recommendations, based on these documents
- Review the first sets of recommendations.

3: Preparing for the co-creation workshops

- Select underdeveloped topics to be discussed in the co-creation workshops
- Create sets of recommendations based on the evidence base of WP3 and WP4
- Develop stimuli that are essential for co-creation workshops.

4: Online toolbox

- Help WP2 with the development of the online toolbox with providing best practices and a solid knowledge base.

2.4 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). The topics also contain subtopics which are relevant for each topic. 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.

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

Rank	Topic	Subtopics
1	Research Integrity Training	<ul style="list-style-type: none"> a. pre-doctorate b. post-doctorate c. training of RI personnel & teachers d. RI counselling and advice
2	Supervision and mentoring	<ul style="list-style-type: none"> a. PhD guidelines b. supervision requirements & guidelines c. building and leading an effective team
3	Dealing with breaches of research integrity	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> a. set-up and tasks of ethics committees b. ethics review procedures
5	Data practices and management	<ul style="list-style-type: none"> a. guidance and support b. secure data storage infrastructure c. FAIR principles
6	Declaration of interests	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> a. publication statement b. authorship c. open science d. use of reporting guidelines e. peer review

		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.

2.4.2 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

8	Updating and implementing RI policy	<i>No subtopics</i>
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	<i>No subtopics</i>

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

2.5 Graphical illustrations of how the topics for the RPOs 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
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: preliminary overview of 9 RI-topics for RPOs that correspond with the EcoC and shows us how they relate to each other.

3. Disciplinary differences

3.1 Lessons learned from WP5

To determine which lessons can be learned from WP5, and in particular the outcomes of the focus groups, which are elaborately described in D5.2, the current deliverable examines the results and outcomes of D5.2. The focus groups were hosted both live and online, due to the COVID-19 pandemic. The focus groups included participants from the four disciplines; humanities, social sciences, natural sciences, medical sciences. In the focus groups, the 9 RPO and 11 RFO topics were discussed (as described above). A total of 30 focus groups took place. The outcomes of the focus groups and in particular differences and similarities between the disciplines is relevant for the current deliverable, since the toolbox will contain tools that are relevant to all main areas of research. In the following, we compare the disciplines (the four main areas of research) in a systematic way and determine the implications for the next version of the toolbox.

3.1.1 Disciplinary differences

Methods of comparing 4 disciplinary fields

To compare the four disciplinary fields, we took the following steps. First, we compared the key features and key observations of the different topics of the four main areas of research by analysing the text and tables of D5.2 from page 38 to 288. The key observations allowed for textual comparison between the main areas of research (in the analysis below also referred to as 'disciplines'). The key features are presented in tables in D5.2, and provide concrete recommendations and ideas for guidelines and SOPs. We compared these recommendations and wrote down similarities and differences.

Second, we categorized the recommendations under themes. For example, under the subtopics pre-doctorate and post-doctorate education and training in RI we identified the themes 'target group of the training' and 'obligatory nature of the training'. These themes were present across the disciplines, and portray similarities or differences. To avoid confusion, the themes we present here are not based on an analysis of the primary data, but are based on analysing the text and recommendations of D5.2. IL compared the disciplinary differences for the RPO topics, and JT compared the differences for the RFO topics. In addition, JT and IL performed this step for the first two topics of RPOs and compared their findings, to increase reliability. When a specific recommendation was mentioned across disciplines this was considered an important finding.

Third, the cross disciplinary differences are described and presented in tables in the sections below. The recommendations often indicate different views from a specific discipline on a certain sub-topic or theme. Moreover, some disciplines had no specific recommendation for a certain theme. This is

also indicated in the table. In addition, we dedicate a section to describe the implications of the findings for the toolbox. These implications will determine how the disciplinary differences should be addressed in the development of the SOPs4RI toolbox.

Fourth, members of WP5 validated the findings and implications for the toolbox. JT and IL were not involved in analysing most of the focus groups (JT was involved in the design of the methodology, the analysis of 2 topics for RPOs and writing of protocols and manuscripts), hence, this extra step allowed for validation. The members of WP5, who performed this step, were closely involved in the analysis of the focus groups and checked whether the disciplinary differences as described in the current deliverable and implications for the toolbox contained the most relevant information. Where necessary, changes were made and information added.

3.1.2 Highlights of the main disciplinary differences per topic/subtopic for RPOs

3.1.2.1 Highlights of disciplinary differences of the topic ‘Education and training in RI’

Rank	Topic	Subtopics
1	Research integrity training	<ul style="list-style-type: none"> a. pre-doctorate b. post-doctorate c. training of RI personnel & teachers d. RI counselling and advice

Table 3: Overview of topics and subtopics for ‘Education and training in RI’

The topic of **education and training in RI** revealed more similarities than differences across the disciplines. One important aspect that all disciplines discussed is who should receive training. Specifically, all disciplines mentioned that training should be given on different levels and span the length of the academic career, with both doctoral students and supervisors receiving RI training. The humanities and natural sciences emphasized the need of supervisors receiving RI training, where the medical sciences also noted the difficulty of time restraint and poor training facilities for seniors. Moreover, making training mandatory was discussed in all disciplines. However, there was no consensus on whether to make training mandatory. There was a tendency to support obligatory training more in the medical sciences, and less in the humanities. (In the humanities, it was even thought that formal training, i.e. courses, are not that helpful). In addition, the recommendations given by the disciplines also discussed the content of the training. All disciplines mentioned the use of real cases as educational material. Within the social sciences the recommendation emphasized integrating personal experience into RI training, but it is most likely that this can be translated to other disciplines as well. Differences across the disciplines concern which topics are important to cover. There was a stronger emphasis on rules and regulations in the medical sciences, while plagiarism was mentioned more often in the humanities. Recurring topics across the disciplines were power dynamics, research culture, supervision, authorship, citations, data management, confidentiality. These topics could be related to which challenges the specific disciplines face. The subtopic *RI counselling and advice* raised the interesting recommendation from both the social and natural sciences of having relevant persons, moments or physical spaces to allow reflection on the “grey area” of RM, and ensuring researchers know how to access this. The humanities mention the importance of diversity in RI counsellors and advisors, and the medical sciences underscore having clear and accessible guidelines in place, as well as having access to space to raise RI issues.

Subtopic	Theme	Humanities	Social sciences	Natural sciences	Medical sciences
Education and training in RI: pre-doctorate and post-doctorate	Target group of the training	Training for PhD supervisors (professors and assistants).	Measures should be taken to make education and training in RI a recurrent process that covers all career stages (from PhD students to professors)	Periodical trainings for seniors.	Education must begin with doctoral students, bachelor and master students should also be educated about RI issues. Senior scientists should also receive trainings.
	Obligatory nature of training	Making training sessions mandatory, only if there are specific guidelines.	Mention of having formal and informal events (e.g. hackathons, mistake cakes etc.)	Courses should be obligatory as long as the content is adequate and challenging.	Make training on RI mandatory
	Use of cases and real life examples	Using real life cases/examples.	Ensure education a & training events to be hands-on, with enough references to concrete research practice and involving experiences of participants	Update educational materials with new cases.	No specific recommendation
	Structure within the institution	No specific recommendation	No specific recommendation	Embed RI into other courses.	Embed RI into other courses.
	Topics to be covered in trainings	Bias, co-authorship, training research participants, PhD supervision, data storage and short term contracts.	Problematic publication practices in the training events, good citation practice, legal and ethical questions regarding data management	Misconduct, data management and lab-work	misconduct, rules & norms, authorship, research ethics issues
	Nature of the training	Share the same values and teaching virtues.	Design in discipline specific ways Daily struggles/gray areas & empowering researchers.	Ethical way of thinking instead of RM. Focus on daily struggles/gray areas & misconduct.	Focus on daily struggles/gray areas & misconduct

Training of RI personnel and teachers		RI teachers should be aware of discipline specific cases/examples. Intervision between trainers/RI-committees can help improve learning	No specific recommendation	No specific recommendation	Introduce the topic of RI in teacher's trainings.
RI counselling and advice	Structure and possibilities of RI counselling	Having domain specific advisors and counsellors (e.g. privacy officers).	Ad hoc advice outside of formal training events. "integrity walk in hour" (and create awareness) Mention of low-threshold counseling being needed.	Having moments and room for reflecting on the grey area and have information easily attainable	Have clear and accessible guidelines and spaces to raise specific issues

Table 4: Recommendations that emerged during the focus groups for the topic education and training. The table specifies the different topics and subtopics, with recommendations categorized under themes. These themes emerged during the focus groups, and portray similarities, new insights or differences for such themes.

Implications for the toolbox

As described above, the topic **education and training in RI** revealed more similarities than differences across the four main areas of research. Important parallels between the disciplines are whom should receive training; PhD students *and* supervisors, the obligatory nature of the training and the use of real life examples or cases. The main divergence can be found in which topics should be covered in the training, and what approach a training program should take. Nonetheless, this can be translated into the concrete recommendation of tailoring training to meet the needs of the four main areas of research. Slight disciplinary differences may be present, such as differing emphasis on specific training topics, form or content. This will not have considerable implications for the toolbox, but one can imagine that training in the humanities may be focusing more on plagiarism and building a culture of RI, while in the social sciences more emphasis could be put on open science and data management plus dealing with and knowing the grey areas of research misbehavior. The natural sciences put more emphasis on laboratory work, data management. This is also more important in the medical sciences where they put more emphasis on rules and regulations and have more need for training in ethics issues, data management and confidentiality.

3.1.2.2 Highlights of disciplinary differences of ‘Responsible supervision and mentoring’

2	Supervision and mentoring	a. PhD guidelines b. supervision requirements & guidelines c. building and leading an effective team
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Table 5: the topic responsible supervision and mentoring.

For the topic **responsible supervision and mentoring** it is important to note only one focus group per discipline discussed the topic. The main area of interest of these focus groups was the supervision relation between PhDs and supervisors, rather than supervising divisions or departments. Different recommendations were given regarding what *PhD guidelines* should be incorporated. The social sciences, for instance, mentioned for issues as authorship, discipline specific guidelines are needed. The natural sciences speculated that national guidelines would be helpful to determine the number of students a supervisor can have. While both disciplines mention guidelines, the guidelines would operate on different levels and cover different issues. The humanities and medical sciences provided specific topics they deemed important for implementation, which covered ownership of publication and providing yearly progress reports, respectively. Interestingly, the natural sciences covered the topic of stopping a PhD. The medical sciences thought of introducing a ‘buddy’ system for PhDs of different levels. The subtopic *supervision requirements and guidelines* yielded more similarities across the disciplines. Two disciplines covered the topic of limiting the number of PhDs a person can supervise, and two disciplines suggested PhD students should have more than one supervisor. Additionally, the medical sciences suggested having a separate mentor and supervisor. Furthermore, across the focus groups the topic of training supervisors was discussed. Supervisors should, for example, complete a training before being allowed to supervise. Lastly, the subtopic of *building and leading an effective team* was only elaborately discussed in the social science. Their recommendation was to make supervision and mentoring performance a serious consideration in professional evaluation.

Subtopic	Theme	Humanities	Social sciences	Natural sciences	Medical sciences
PhD guidelines	Guidelines	Implement ownership of publications in guidelines.	Work towards discipline-specific guidelines for responsible supervision, in particular with respect to co-authorship and related questions	Setup national guidelines.	Implement in the guidelines that yearly progress reports should be provided
		No specific recommendation	No specific recommendation	How to end/stop a PhD	Introducing a buddy system for PhDs of different levels
Supervision requirements & guidelines	Amount of PhDs of a supervisor	Set a limit of PhDs a person can supervise.	No specific recommendation	No specific recommendation	Limit the amount of students a supervisor can have
	Who should supervise the PhD student	A PhD should have more than one supervisor.	No specific recommendation	Requirement of two supervisors or supervising committee.	Having separate mentors and supervisors
	Periodical reports and supervision hours	No specific recommendation	No specific recommendation	No specific recommendation	Yearly report on supervisees & have a minimal number of supervision hours
	Training	Provide tailored training to assistant and associates that supervise PhDs.	Offer more training for mentors & supervisors	No specific recommendation	No specific recommendation
Building and leading an effective team		No specific recommendation	Make supervisory & mentoring performance a serious consideration in professional evaluation	No specific recommendation	No specific recommendation

Table 6: Recommendations that emerged during the focus groups for the topic supervision and mentoring The table specifies the different topics and subtopics, with recommendations categorized under themes. These themes emerged during the focus groups, and portray similarities, new insights or differences for such themes.

Implications for the toolbox

The four main areas of research had slight diverging views on the subtopic *PhD guidelines*, while the subtopic *supervision requirements and guidelines* provided more similarities. Specifically, how PhD guidelines should be set up differs between the disciplines. For the social sciences and humanities, a concrete difference is to provide guidelines for publication and (co)-authorship. For the natural sciences national guidelines are key, with the medical sciences stating yearly progress reports are necessary. These recommendations are not mutually exclusive. Guidelines for supervision are currently absent in most instances. The subtopic supervision and mentoring yielded many similarities, importantly, limiting the amount of PhD students a supervisor can have and having more than one supervisor are recommendations that go across disciplines.

3.1.2.3 Highlights of disciplinary differences for ‘Dealing with breaches of RI’

3	Dealing with breaches of RI	<ul style="list-style-type: none"> 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)
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Table 7: Overview of topics and subtopics for ‘dealing with breaches of RI’

The topic **dealing with breaches of RI** has a large number of subtopics which may have been the reason for a more scattered division of recommendations. The subtopics RI bodies in the organization and procedures for investigating allegations were discussed more prominently than other subtopics. The subtopic ‘other actions, including mobility issues’, however, did not generate any specific recommendations.

For the subtopic *RI bodies in the organization* we identified three themes. The first theme is the process for filing complaints and the process of official procedures. Within the humanities and natural sciences, the main recommendations are comparable in their focus on providing clarity on filing complaints, which channels are appropriate to file complaints and how RM cases are officially handled. The social- and medical sciences did not provide specific recommendations on this theme, although they did highlight the topic as complex as many forms of breaches of RI exist. Therefore, all disciplines, and social sciences specifically emphasize the need for clarity for procedures and complaints. Another interesting finding is that there are big differences between countries on how clear procedures are. Some countries have completely non-existing procedures, while others have extensive guidelines for this. Furthermore, the theme communication and interaction with researchers and the public was identified, with the recommendations varying greatly across the disciplines. The humanities, for example, focused on the provision of clarity of what constitutes a

breach versus a human resource or management issue. Therefore, complaints and procedures should be clearly demarcated. In the social sciences however, focused on researchers being able to receive informal advice on RI issues. Whereas the natural sciences and the biomedical sciences emphasized the channels for filing complaints should be visible, and the medical sciences emphasized the communication with the public when a breach occurs needs to be improved. The third theme concerned resources of RI committees, with both social and medical sciences recommending more resources needing to become available. This was also briefly discussed in the other disciplines with a focus of a sometimes slow response of these committees.

The second subtopic discussed is the *protection of whistleblowers*. The social sciences indicated guidelines are necessary to protect whistleblowers, and the natural sciences highlighted the importance of the right to anonymity.

The third subtopic concerns the *protection of those accused* of RM. An interesting recommendation here was given by the natural sciences. They stressed that anonymity should be warranted until a severe breach of RM was proven. Nonetheless, the privacy of the researchers should be respected when it concerns an honest error or minor breach.

The fourth subtopic concerns the *procedures for investigating RM*. The humanities and natural sciences both mentioned having confidentially counsellors in place before filing official complaints. A potential solution for this problem was mentioned in the social sciences: preventive measures could be the creation of more informal contact points where researchers can inquire in case they are unsure about potential RI breaches. The social sciences suggested having flexible disciplinary specific means of investigating breaches and the medical sciences suggested having external members involved in committees, especially in small universities and research organizations. The last covered subtopic, *sanctions*, raised a diverse set of recommendations. The social sciences stressed a focus on prevention rather than sanctions. The natural sciences highlighted the importance of having clear guidelines in place regarding which sanctions apply to types of research misconduct. However, the medical sciences took it one step further by stating that imposing the sanctions is a way of conveying the message that research misconduct is unacceptable.

Subtopic	Theme	Humanities	Social sciences	Natural sciences	Medical sciences
RI bodies in the organisation	Process for filing complaints and procedures	Clarity on how to file complaints. Including which channels are available for filing complaints.	No specific recommendation	Clarity on the processes & transparency of rights of all those involved in the process.	No specific recommendation
	Communication and interaction	Clarity on what can be considered a breach of integrity versus a human resource or management problem.	Create more informal opportunities for getting advice on RI issues, e.g. an “integrity walk-in hour”	Visibility of channels for complaints	Communicate better with the public when breaches happen
	Resources	No specific recommendation	Mobilize more resources for review boards	No specific recommendation	Committees should be allowed to act swiftly and should be paid for their work
Protection of whistle-blowers		No specific recommendation	Create guidelines and institutional structures to protect whistleblowers	Right to anonymity	No specific recommendation
Protection of those accused of misconduct		No specific recommendation	Create more effective institutional structures to investigate misconduct allegations	Right to anonymity unless breach is proven. For honest mistakes or minor breaches privacy should be respected.	No specific recommendation
Procedures for investigation allegations		Assign advisors or counsellors to talk about RM issues before	Ensure flexible and field-specific means of investigating misconduct	Confidential counselors	Committees should have external members that

		filing an official complaint.			are not from the same institution
Sanctions		No specific recommendation	Prioritize preventive measures over sanctions	Guidelines should include whether there are consequences if a breach has been established	Sanctions, including imposing them, are to convey the message that breaches are unacceptable
Other actions (including mobility issues)		No specific recommendation	No specific recommendation	No specific recommendation	No specific recommendation

Table 8: Recommendations that emerged during the focus groups for the topic dealing with breaches of RI. The table specifies the different topics and subtopics, with recommendations categorized under themes. These themes emerged during the focus groups, and portray similarities, new insights or differences for such themes.

Implications for the toolbox

While the topic dealing with breaches of RI covered a range of recommendations, with differences between the disciplines, the topic is of a legalistic nature, with procedures for dealing with misconduct serving as guidance on an institutional level and/or national level. Hence, disciplinary differences should play a minor role in preparing SOPs/guidelines for this topic, and the recommendations given by all disciplines serve to guide the preparation of the toolbox. This means that most recommendations that came out of the focus groups can be extrapolated to all disciplines with the strongest focus on the legalistic nature and the fact that clarity on procedures, transparency of the timeline of a procedure and breaches is essential for all disciplines. Nonetheless, the humanities and the social sciences highlighted the importance of demarcating what constitutes research misconduct. A breach of RI in the humanities can be different from the natural or medical sciences, and there are slight differences between disciplines when it comes to what constitutes research misconduct and what is considered an honest error. Moreover, procedures for dealing with breaches should be field-specific. Thus, the toolbox needs to leave room for discipline specific structures and procedures.

3.1.2.4 Highlights of disciplinary differences ‘Research ethics structures’

4	Research ethics structures	a. set-up and tasks of ethics committees b. ethics review procedures
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Table 9: Overview of the topics and subtopics for ‘Research ethics structures’

Research ethics structures was not widely covered in the focus groups of the humanities. Therefore, no specific recommendations were made, although concerns were raised that these structures can become an administrative burden and a tick-box exercise. The other three disciplines did discuss the topic. Interestingly, all disciplines had differing ideas on the subtopics and the identified themes. For the subtopic *set-up and tasks of committees* three themes were identified. The first is resources, with the three disciplines emphasizing more resources should become available for review boards and should be available for ad-hoc questions and doubts. Second was the topic of processing requests. The social sciences explicitly discussed how recurrent requests, especially legal and data management requirements should be properly outlined in guidelines, and doubts/ad-hoc questions should be answered quickly to prevent undermining the speed of research processes. The natural sciences focused on flexibility of structures to account for disciplinary differences and to avoid meaningless checklists. The medical sciences stressed the need for clarification of different ethical approvals for a project and that the review procedures must be swift. The third theme was the function of the committee and information they should provide. The social sciences stressed clarifying the function of the (ethical review boards) ERBs and their legal status of decisions. The natural sciences stressed information and standards should be developed at a European level while at the same time being flexible to account for disciplinary differences. Although difficulties in organizing this were also recognized. Lastly the medical sciences suggested a contact person should be available for any doubts on the process.

The second subtopic was the *ethics review procedures*. Here, the focus of the social sciences lay on the ERBs having the relevant (disciplinary specific) knowledge available to adequately process requests. The medical sciences, however, stressed the need for clarification of the information provided to the researchers, and having swift procedures.

Subtopic	Theme	Humanities	Social sciences	Natural sciences	Medical sciences
Set up and tasks of committees	Resources	No specific recommendation	Mobilize more resources for review board	No specific recommendation	No specific recommendation
	Processing requests	No specific recommendation	Provide guidelines on how to handle recurring legal questions and data management issues, and provide dedicated advisors with relevant expertise	Flexible structures for each discipline	Consider the different ethical approvals a project may need
	Function and information	No specific recommendation	Make sure to clarify the function of ERBs as well as the exact legal status of its decisions	Information and standards at European level	Assign a contact person for doubts
Ethics review procedures	Differences in requests	No specific recommendation	Ensure that ERBs possess the necessary disciplinary diversity to do justice to the diverse projects they are asked to review	No specific recommendation	Review procedures should be swift, provide clear information about the procedure, and have checklists on what to send

Table 10

Implications for the toolbox

Similarly, to the topic of Dealing with Breaches of RI, the topic of **Research ethics structures** reveals some general needs across disciplines as well as discipline specific approaches for the toolbox. While for the humanities there were fewer specific recommendations, most likely due to the fact that most research domains in the humanities face fewer ethical issues than what is the case within, e.g., medical or social science. The other three main areas of research require a distinct approach. Importantly, the social sciences stresses that the function and legal status of the ERB should be clarified. In the natural and medical sciences this seems to be slightly less important, most likely

because the function of the ERB's is already more embedded within the institutional structure. Regarding the procedures, the medical sciences' recommendation includes that the procedures should become quicker, contain checklists on what to send, and make sure that researchers can contact the ERB fast with ad-hoc doubts or concerns. The social sciences require diversity in the ERBs to ensure that relevant knowledge is available to assess the range and diversity of research projects in the social sciences. All these recommendations are most likely also applicable to the other domains and we would be reluctant to make clear distinctions between disciplines here. The best approach would be to call for guidelines that should be mindful and flexible when disciplinary differences are taken into account when applying guidelines.

3.1.2.5 Highlights of disciplinary differences for 'Data practices and management'

5	Data practices and management	a. guidance and support b. secure data storage infrastructure c. FAIR principles
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Table 11: Overview of the topics and subtopics for 'Data practices and management'

The topic **data practices and management** cover three subtopics: *guidance and support*, *secure data storage infrastructure* and *the FAIR principles*. For the topic *guidance and support* we identified two themes, the first concerns discipline specific support and the second theme is the type of support that should be given. Both the humanities and social sciences suggested that support should be tailored to the specific disciplines and fields; with the former focusing on the provision of examples as guidance and the latter suggesting the trainings should do justice to manage different types of data. The second theme covers the type of support. The humanities stressed the notion of clarity and where to find support, the natural sciences emphasized the importance of tailored support for PhD students, and the medical sciences found clarity on IT and legal issues important. While not translated as a specific recommendation in all disciplines it is worth noting all disciplines elaborately discussed the impact of the GDPR on data management. Notably, lack of guidance on compliance with the GDPR was explicitly stressed by the social sciences.

The second subtopic covered secure data storage and infrastructure. Both the humanities and natural sciences mentioned the possibilities of having support for ad-hoc needs. The social sciences also recommend the need for a balance between attention to local practices and standardization of data management within and across countries and across institutions. The medical sciences provide a similar recommendation with a central data repository on a national level being key.

Lastly, the challenges of implementing the FAIR principles (Findable, Accessible, Interoperable and Reproducible) in the humanities and social sciences were stressed. Nonetheless, no specific recommendations of implementing the FAIR principles were given by these disciplines. The natural

and medical sciences did provide recommendations, specifically for sharing data in large collaborations across European (and other) countries.

Subtopic	Theme	Humanities	Social sciences	Natural sciences	Medical sciences
Guidance and support	Discipline specific support	Clear guidelines per field and discipline, with examples.	Ensure instruction and training to be field-specific, e.g. to do justice of different disciplinary data practices	No specific recommendation	No specific recommendation
	Type of support	Clarity on where to find support and documentation	Better and field specific instructions on how to be GDPR-compliant	Provide clear guidelines and tailored support to PhDs on data management	Provide support on IT and legal issues
Secure data storage and infrastructure		Support for ad-hoc needs	Foster overarching approaches and standards to data management across institutions/countries	Allow ad-hoc and flexibility in how data is managed	A central data repository on a national level
FAIR principles		No specific recommendation	No specific recommendation	General protocols for storing and sharing for all of Europe	Sharing data between different countries

Table 12: Recommendations that emerged during the focus groups for the topic data practices and management. The table specifies the different topics and subtopics, with recommendations categorized under themes. These themes emerged during the focus groups, and portray similarities, new insights or differences for such themes.

Implications for the toolbox

The different issues discussed in relation to data management, and the various recommendations that were given, have various implications for the toolbox. The type of support given differs slightly among the disciplines, however, access to and the provision of tailored support on data management is stressed in the humanities, natural, and medical sciences. In addition, support on compliance to the GDPR needs to be incorporated were discussed in the social sciences groups, but is applicable for all disciplines. For both the humanities and natural sciences, ad-hoc support was requested, but this is also meaningful for the other main areas of science. The social sciences stressed standardization

and the medical sciences recommend the establishment of a central repository, which is also relevant for other main areas of science.

3.1.2.6 Highlights of disciplinary differences for ‘Declaration of interests’

6	Declaration of interests	<ul style="list-style-type: none"> a. in peer review b. in the conduct of research c. in appointments and promotions d. in research evaluations e. in consultancy
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Table 13: Overview of topics and subtopics for ‘Declaration of competing interests’

The topic **declaration of interests** was not widely discussed in the focus groups, no specific recommendations were given by any of the disciplines. The humanities did not consider CoIs an issue for their discipline. In the social sciences the main point of discussion involved the evaluation of academic achievements being heavily dependent on publications and grants, however, this topic was considered more in line with topic 7—research environment. In the natural sciences and the medical sciences, the general thought was that CoI was already well regulated by journals. However, a point of concern was enforcing or checking the proof of the CoI. In the medical sciences, the groups raised the issue of working in small institutions as potential increase of CoI and how this should be dealt with. Moreover, some respondents of the medical focus groups suggested to create more awareness on how to declare competing interests for junior researchers. Nonetheless, no explicit recommendations are given for the topic and subtopics.

Implications for toolbox

When it comes to Conflicts of Interests, there are minor differences between the disciplines that are worth mentioning: for the humanities CoI are localized mostly in peer review, and in how appointments and promotions are given. In the social, natural and medical sciences, evaluation and appointment procedures are also sensitive for CoI, specifically in commercial collaborations. The participants also briefly highlighted the big national differences on awareness and adjustments of CoI. The tools for dealing with CoI in the toolbox should be wide enough to embrace all of these examples.

3.1.2.7 Highlights of disciplinary differences of ‘Research environment’

7	Research environment	<ul style="list-style-type: none"> 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)
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Table 14: Overview of topics and subtopics for ‘Research environment’

The topic **research environment** covers a diverse set of subtopics. This topic was elaborately discussed by the different disciplines; however, some subtopics were discussed more in-depth than others. In addition, no overarching themes were identified for this topic, and the 7 subtopics gave room to ample recommendations. The subtopic *fair procedures for appointments, promotions and numerations* received considerable attention from all four disciplines. The humanities’ recommendation suggested that the criteria for promotions should be more transparent as they are now vague, inconsistent and hard to comply with, and this can most likely be extrapolated to other disciplines. All disciplines specified other academic tasks, especially teaching, should be increasingly valued in promotions.

The second subtopic covers *adequate education and skills training*. Here, the natural and medical sciences were aligned in stating that regular meetings should become part of the research culture to discuss the progress of work and bring potential (RI)-issues to light. The humanities specified that RI training is necessary next to having good guidelines in place and that this also influences research environment.

The third subtopic covers *culture building*. The social and natural sciences specified transparency of evaluation and promotion criteria is necessary to create a healthy working sphere as applying some promotion criteria can incentivise various forms of research misbehaviors and negatively impact research culture. More openness is necessary. Within the humanities changing the culture of short term contracts was considered to be important to change the working environment.

The fourth subtopic covers *managing completion and publication pressure*. While the natural sciences focused on avoiding requirements of having a set amount of papers to get grants or promotions, the humanities’ recommendation specified shifting the focus from quantity towards quality of publications and this can be extrapolated to other disciplines as they face the same problems that promotion criteria are rewarding and incentivizing quantity.

The fifth subtopic covers *conflict management*, with the natural sciences providing the only recommendation and is easy to translate to the other disciplines. They discussed the possibilities of organizing training in conflict management, especially for those collaborating in large consortia.

The sixth subtopic covers *diversity issues in the research environment*. Only the social sciences provided a specific recommendation which focused on ensuring diversity and transparency of evaluation criteria. Although this is not discussed in the other disciplines, this is applicable to them as well.

The last subtopic covers *supporting a responsible research process*. This subtopic was covered by the social, medical and natural sciences. In the social sciences, the need to find a balance between the tightness and flexibility of regulations in research organisation was recommended. Within the natural sciences quality, specifying how data will be analysed, and presenting decisions about the research process were given as recommendations. In the medical sciences, they opt for spaces for discussions and interactions to foster a responsible research culture.

Subtopic	Theme	Humanities	Social sciences	Natural sciences	Medical sciences
Fair procedures for appointments, promotions and numeration	None	Make clear and transparent criteria for appointments and promotions.	RPOs should ensure that other forms of academic performance, for example excellent teaching and administration are adequately valued.	Include in evaluation other type of output and activities beyond publication in journals and grants received.	Focus on quality rather than quantity (of research output). And value teaching .
Adequate education and skills training	None	Adequate training is needed next to guidelines.	No specific recommendation.	Create periodical sessions where researchers can discuss progress, issues, and dilemmas.	Have regular lab meetings to discuss issues and results.
Culture building	None	Change culture of short-term contracts. Ensure transparency on evaluation criteria	Ensure transparency of evaluation and promotion criteria.	No specific recommendation.	No specific recommendation.
Managing competition & publication pressure	None	Focus on the quality of	No specific recommendation.	Avoid requirements of having X number	Focus on the quality of publications, not on the quantity

		publications, not on the quantity		of papers as first author	
Conflict management	None	No specific recommendation.	No specific recommendation.	Provide training in conflict management for team leaders and those dealing with large consortia.	No specific recommendation.
Diversity issues	None	No specific recommendation.	Ensure diversity and transparency of evaluation criteria	No specific recommendation.	No specific recommendation.
Supporting a responsible research process	None	No specific recommendation.	Need for RPOs to find a balance between being too strict/too lenient in regulating research processes on the academic shop floor.	Base research evaluation in quality not quantity. Specify how data analysis will be approached. When presenting results, provide information about how decisions were taken	Focus on the quality of publications, not on the quantity.

Table 15: Recommendations that emerged during the focus groups for the topic research environment. The table specifies the different topics and subtopics, with recommendations categorized under themes. These themes emerged during the focus groups, and portray similarities, new insights or differences for such themes.

Implications for the toolbox

For the topic research environment, the disciplinary differences should have various implications for the toolbox. For the subtopic fair procedures for appointments and promotions, the toolbox should incorporate the value of teaching, non-research activities and quality of research for all disciplines. They all recommend that clear and transparent promotion criteria are essential for a healthy research environment. For the second subtopic, education and skills training, the recommendation from the natural and medical sciences both included having periodical sessions to discuss progress, which should be implemented discipline-specific in the toolbox. For the subtopic culture building, the humanities recommendations of changing the culture of short term contracts can be implemented, with the social sciences wanting to improve transparency of evaluation and promotion criteria. These recommendations are most likely also applicable to the other disciplines. For the subtopics conflict

management and publication pressure, only one of the disciplines provided recommendations, which can be taken up by the toolbox (see table 15). For the last subtopic, supporting a responsible research process, the social sciences have the specific recommendation of finding a balance in regulating the research process but most likely is applicable to all disciplines. This should be taken into consideration when developing the toolbox. The natural sciences' focus lay with the evaluation of research, with quality trumping quantity. This should also be considered for all disciplines.

3.1.2.8 Highlights of disciplinary differences of 'Publication and communication'

8	Publication and communication	<ul style="list-style-type: none"> a. publication statement b. authorship c. open science d. use of reporting guidelines e. peer review f. predatory publishing g. communicating with the public
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Table 16: Overview of the topics and subtopics for 'publication and communication'

The topic **publication and communication** cover seven subtopics. The sub-topic *authorship* raised the most issues among the differing disciplines. On the one hand the humanities and medical sciences aligned by emphasizing the importance of awareness of authorship guidelines. On the other hand, the social sciences found tailoring guidelines to specific disciplines important, and the natural science also underscoring the importance of clear authorship guidelines. The sub-topic *open science* raised issues related to the financing of open access publishing within the social and medical sciences. Their recommendation is to have financial support for publishing open access by their institution and this is most likely applicable for all disciplines. The humanities and natural sciences also aligned in their recommendation about making registration of research obligatory. The fourth sub-topic, *use of reporting guidelines*, was only covered in-depth by the social sciences. Creating better visibility for existing reporting guidelines is deemed important. The sub-topics *peer review* and *predatory publishing* did not yield specific recommendations. Lastly, the sub-topic *communication with the public* was only extensively covered by the medical sciences. Their suggestion is to focus on the fact that researchers should not exaggerate their findings to the public.

Subtopic	Subject	Humanities	Social sciences	Natural sciences	Medical sciences
Publication statement	Guidelines and evaluation	Make international	No specific recommendation	Balance the relevance of publication for	No specific recommendation

		guidelines per discipline.		funding and evaluations	
Authorship	Guidelines	Empower juniors by making them aware of guidelines.	Encourage the use of existing authorship guidelines across institutions and ensure that guidelines on how to deal with authorship are field-specific.	Clear guidelines for complex situations allowing room for interpretation.	Define authors in advance and ensure researchers of all levels are aware of the guidelines.
Open science	Repository & finances	Make data visible and publish preprints	Allocate? financial support for open access publishing.	Make the publication in repositories obligatory but provide enough resources.	It needs to be encouraged and supported by RPOs.
Use of reporting guidelines	None	No specific recommendation	Create better visibility for existing guidelines and resources.	No specific recommendation	No specific recommendation
Peer review	None	No specific recommendation	No specific recommendation	No specific recommendation	No specific recommendation
Predatory publishing	None	No specific recommendation	No specific recommendation	No specific recommendation	No specific recommendation
Communicating with the public	None	No specific recommendation	No specific recommendation	No specific recommendation	Researchers should not give misleading or exaggerated statements.

Table 17: Table 18: Recommendations that emerged during the focus groups for the topic publication and communication. The table specifies the different topics and subtopics, with recommendations categorized under themes. These themes emerged during the focus groups, and portray similarities, new insights or differences for such themes.

Implications for the toolbox

The most important implications for the toolbox concern the sub-topics authorship and open science. For the first subtopic the use and awareness of existing guidelines should be taken up and be considered for all disciplines. For open science, the medical, social and natural sciences recommend creating repositories and making these obligatory. Although this may be less applicable for the humanities, this is also a recommendation for some fields in the humanities. For all disciplines (financial) support for open access publishing needs to be shared by the RPOs.

3.1.2.9 Highlights of disciplinary differences of ‘Research collaboration’

9	Research collaboration	a. among RPOs inside/outside the EU b. with countries with different R&D infrastructures c. between public and private RPOs
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Table 19: Overview of the topics and subtopics for ‘collaboration in research’

The topic **Research collaboration** among RPOs covers three subtopics: ‘among RPOs inside and outside the EU’, ‘with countries with different R&D infrastructures’ and ‘between public and private RPOs’. The first subtopic was only covered by the natural and medical sciences. Within the natural sciences the main point of concern was members being added to large research collaborations to ‘up’ their publication rate. Therefore, the recommendation is to limit the size of teams for research collaborations. For the medical sciences an important point is the provision of clearer rules on obtaining ethical approval within collaborations. The second sub-topic covers collaborations between countries with different R&D standards. Here the only specified recommendation was provided by the social sciences, which focused on the lack of technical and data management standards of collaborations. The main challenges in collaborations are sharing data safely, with different institutions using different cloud servers. The last subtopic covered *collaborations between public and private RPOs*. The main recommendations were provided by the natural and medical sciences, which covered sharing of information and the contractual obligations for the former, and keeping registries of public-private collaborations for the latter.

Subtopic	Subject	Humanities	Social sciences	Natural sciences	Medical sciences
Among RPOs inside/outside the EU		No specific recommendation.	No specific recommendation.	Limit size of teams to include only those actually working on a project.	Clearer rules concerning ethical approvals.
With countries with different R&D infrastructures		No specific recommendation.	Foster overarching approaches and standards to data management across institutions/countries.	No specific recommendation.	No specific recommendation.
Between public and private RPOs		No specific recommendation	No specific recommendation	Share information of the contract and obligations of both parties with researchers involved.	Each RPO should keep a registry of private-public collaborations. And the head of institute or department should approve private-public collaboration.

Table 20: Recommendations that emerged during the focus groups for the topic collaboration. The table specifies the different topics and subtopics, with recommendations categorized under themes. These themes emerged during the focus groups, and portray similarities, new insights or differences for such themes.

Implications for the toolbox

For the first subtopic, collaborations among RPOs inside and outside the EU, the medical and natural sciences need distinct approaches in the toolbox. The medical sciences' recommendations of having clarity on ethical approval needs to be implemented. For the natural sciences, the recommendation on team size can be incorporated. For the subtopic collaboration with countries with different R&D structures, the social sciences require standardization to data management in collaborations. The last subtopic, collaboration between public and private RPOs again requires a separate approach for the natural and medical sciences. The natural sciences recommendation implies that contractual obligations need to be shared. The medical sciences, on the other hand, specifies that private-public collaborations need to be kept in registries. Lastly, the natural and medical sciences are likely more often involved in such collaborations, and therefore have more and specific ideas on this topic.



However, it is important that these recommendations and regulations are also put in place for the humanities and social sciences.

3.1.3 Disciplinary Differences for RFOs

In the section below the disciplinary differences and similarities for the RFOs will be described. Recommendations as provided in D5.2 (pg. 158-288) are compared and described below. The methods of the comparison is described in section 3.1.1

3.1.3.0 Lessons learned from WP5

The work below examines the results and outcomes of the RFO-focused interviews in WP5, as reported in D5.2. The RFO focus groups included participants from the four disciplines - humanities, social sciences, natural sciences, medical sciences – including relevant stakeholders. A total of 16 focus groups focussed on the RFOs. The toolbox will create tools tailored to the different disciplinary needs of the RFOs. Below, we compare the disciplines in a systematic way and determine the implications for the next version of the toolbox. During the discussion of the main topics, some of the subtopics were also discussed briefly or at length. However, the goal was not to discuss all the subtopics in detail and therefore some disciplines do have more recommendations on certain subtopics than others.

3.1.3.1 Highlights of disciplinary differences of ‘Dealing with Breaches of RI’

Rank	Topic	Subtopic
1	Dealing with breaches of RI	<ul style="list-style-type: none"> 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

Table 21: Overview of the topics and subtopics for ‘Dealing with breaches of RI’

The topic **dealing with breaches of RI** has 8 subtopics, making it difficult to detect the similarities and the differences per subtopic. Besides, contrary to the RPOs on the topic research misconduct, the material from the focus groups of the RFOs seems less rich in content. Moreover, several general recommendations were given covering more than one subtopic. Especially the social sciences discussed general aspects that RFOs need to take into account when they have to deal with breaches of RI. The identified themes ranged from expectations of RPOs, to research culture and prevention (not specifically addressing the subtopics above). Prevention was stressed by the social sciences since

in the experience of the focus groups many RM cases were due to misunderstandings and lack of understanding about how to perform research in a good manner and RFOs could help demanding better structures for RI. Solving these misunderstandings, and even better, preventing these, were thought to be of higher relevance than punishing researchers. In addition, both the social and natural sciences have the recommendation of requiring RPOs to have specific organisational structures or persons who can deal with breaches of RI's, and also to have trust in persons who can be approached. The first subtopic, *RI bodies in the organisation* was only covered by the natural sciences. They underscore the responsibility funders need to take in countries without national or legal ways of handling research misconduct. The second subtopic is *procedures for breaches by funded researchers*. The medical sciences specified that handling RM cases should be specified in grant agreements beforehand. The third, fourth and fifth subtopic, *dealing with breaches of review committee members, reviewers and staff members* do not have any recommendations. The sixth subtopic, *protection of whistle-blowers and those accused of RM* was covered by the humanities. Their recommendation is to make simple, fair and fast procedures concerning protection. The seventh subtopic, sanctions, raised some interesting recommendations. Both the humanities and medical sciences highlighted the role of RFOs in paying attention to RM cases. The humanities stated a registry of RM cases should be developed, and the medical sciences stated clear agreements should be in place before the start of research. Furthermore, the social sciences stated a comprehensive investigation should be conducted prior to installing any repercussions. Lastly, the subtopic *communicating with the public* was only covered by the natural sciences. They stress RPOs needing to exercise transparency and communicate openly (with the RFO). Since most subtopics were not extensively discussed in all disciplines, it remains a bit unclear whether we can translate the recommendations to the other disciplines as well. For most recommendations, this is the case, specifically for this topic.

(Sub)topic	Theme	Humanities	Social sciences	Natural sciences	Medical sciences
Dealing with Breaches of RI	Expectation of RPOs	No specific recommendation	Demanding RPOs to have procedures in place	No specific recommendation	No specific recommendation
	Culture	No specific recommendation	Create culture with room for mistakes	No specific recommendation	No specific recommendation
	Prevention	No specific recommendation	Focus on prevention	No specific recommendation	No specific recommendation

	Structures, bodies and persons who can deal with RM	No specific recommendation	Structures, bodies and persons who can deal with this at RPOs, e.g. trust persons/counselling	Structures, bodies and persons who can deal with this at RPOs, e.g. trust persons/counselling	No specific recommendation
RI bodies in the organisation	None	No specific recommendation	No specific recommendation	Funders take a bigger responsibility in countries without national procedures and legal systems for dealing with misconduct	No specific recommendation
Procedures for breaches by funded researchers	None	Structures, bodies and persons who can deal with this at RPOs, e.g. trust persons	No specific recommendation	No specific recommendation	Describe in grant agreement how breaches will be handled
By review committee members	None	No specific recommendation	No specific recommendation	No specific recommendation	No specific recommendation
By reviewers	None	No specific recommendation	No specific recommendation	No specific recommendation	No specific recommendation
By staff members	None	No specific recommendation	No specific recommendation	No specific recommendation	No specific recommendation
Protection of whistle-blowers and the accused	None	Make a simple, fair and fast procedure at RPOs	No specific recommendation	No specific recommendation	No specific recommendation
Sanctions/other actions	None	Create a national or cross-national registry of researchers with special attention in RFOs for misconduct cases	Thorough investigation before jumping to conclusions and sanctions	No specific recommendation	Attention in RFO for misconduct cases & clear agreements on violations in the grant agreement
Communicating with the public	None	No specific recommendation	No specific recommendation	RPOs exercise transparency and	No specific recommendation

				responsibility when they encounter a case of misconduct	
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Table 22: Recommendations that emerged during the focus groups for the topic dealing with breaches of RI. The table specifies the different topics and subtopics, with recommendations categorized under themes. These themes emerged during the focus groups, and portray similarities, new insights or differences for such themes.

Implications for the toolbox

The topic **dealing with breaches of RI** is of a legalistic nature and closely connected to national legislation. The RFO can play a role in strengthening the structures, but the responsibility of dealing with breaches of RI lies with the RPOs and national legal systems. Furthermore, as was stressed when dealing with this topic for RPOs, the issues highlighted above should be understood as different ideas and recommendations generated in the different main area of research's focus group discussions. However, most of them are generic ideas that can be implemented across disciplines to strengthen RI and deal with breaches of RI.

Many of the recommendations can be taken up in the toolbox. This is, for instance, the case with the social sciences' recommendations of creating a culture with room for mistakes and a focus on prevention. These two recommendations are important for all disciplines. Many other recommendations can also be taken up, such as ensuring that legal procedures for dealing with RM are in place, having simple and fair procedures for protection of whistleblowers and those accused of RM, and specifying in the grant how RM cases will be handled.

3.1.3.2 RFO Topic 2: Declaration of competing interests

2	Declaration of competing interests	a. among review committee members b. among reviewers c. among staff members
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Table 23: Overview of the topics and subtopics of 'declaration of competing interests'

The topic **declaration of competing interest** has three subtopics, each covering different disciplines involved in RFOs. The first subtopic, *declaration of competing interests among review committee members* came up in discussions in humanities and social sciences groups. Recommendations of changing reviewers (especially at European level) and not having reviewers from the same organization were suggested. For the second subtopic *declaration of competing interests among reviewers* humanities, natural and medical science groups came up with a similar recommendation of attracting international reviewers, as this is important to get an international perspective and

prevent potential conflicting interests. In addition, the humanities specified that applicants should have the option to state a reviewer to be disqualified for the review, just as in the peer review process of journals. The third subtopic, which concerns *Col for staff members*, was brought up in the discussions in a humanities group that suggested implementation of courses on funding ethics.

(Sub)topic	Theme	Humanities	Social sciences	Natural sciences	Medical sciences
Declaration of competing interests		No specific recommendation	No specific recommendation	No specific recommendation	No specific recommendation
Among review committee members		Committee members, and particularly at the European level, should change with every call	Avoid conflict of interests in committees by not letting people from the same organizations review each other's work	No specific recommendation	No specific recommendation
Among reviewers	Geographical spread	Greater efforts to engage international reviewers	No specific recommendation	Greater use of reviewers that academically are close to the application topic, for instance by increasing the use of international review-ers (also section 3.1.3.4)	Look for reviewers outside of Europe
	Disqualification	Possibility for the applicant to indicate whether a reviewer would be seen as disqualified	No specific recommendation	No specific recommendation	No specific recommendation
Among staff members		Short courses on funding ethics to potential funding stakeholders	No specific recommendation	No specific recommendation	No specific recommendation

Table 24: Recommendations that emerged during the focus groups for the topic declaration of competing interests. The table specifies the different topics and subtopics, with recommendations categorized under themes. These themes emerged during the focus groups, and portray similarities, new insights or differences for such themes.

Implications for the toolbox

The topic, **declaration of competing interests**, was discussed in various ways by all disciplines. Some disciplines mainly paid attention to conflicting interests among reviewers, others conflicting interests among review committee members. Several suggestions for how RFOs can handle conflicting interests came up in the discussions, as highlighted above in table 23. Although the suggestions came up in specific main areas of research's discussions, all of them are generic ideas that can be implemented across disciplines to handle competing interests.

Many of the recommendations can be taken up in the toolbox, such as changing reviewers, as suggested in the humanities, and avoiding people from the same organization reviewing each other's work, as suggested in the social sciences. Three main areas of research also suggested a focus on attracting international reviewers, but this seems to be a good idea for all disciplines. The recommendation of courses on funding ethics, as suggested in the humanities, is also an idea for the toolbox.

3.1.3.3 RFO Topic 3: Funders expectations of RPOs

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
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Table 25: Overview of topic and subtopics for 'funders expectations of RPOs'

The third topic, **funders expectations of RPOs** was elaborately discussed among the different disciplines. Importantly, funders were thought to make a real difference on RI practices. Three general recommendations were provided concerning the topic, and the disciplines were closely aligned in their recommendations covering the set of subtopics. First, in focus group discussions in three out of four disciplines it was discussed that RFOs can require and check that RPOs have the relevant RI codes and guidelines in place. Only when this is checked and the right structures are in place, the RPO can receive funding. This should be about institutional rules, and not only focus on specific research projects. In addition, different strategies to check this were discussed (see table below). This was specifically highlighted in the medical sciences focus groups. Second, we identified the general themes reflection on research practices and control systems, where recommendations from the social and medical science group were provided. For the first subtopic, codes of conduct, no specific recommendations were formulated. Codes, procedures and guidelines were discussed in many groups, but on a very general level. The issues of funders' setting expectations to RPOs on having some codes and procedures in place was discussed, but not necessarily with specific focus on formal CoCs. However, the natural sciences elaborately discussed the problem with CoCs developed by RFOs (also specified in the table). While not given as a concrete recommendation, this problem can be considered when RFOs develop a CoC. The second subtopic *assessment of researchers* was hardly discussed. Only the social sciences recommended that assessment of researchers that apply for funding should not be a tick box exercise but should entail rewarding good practices and give a multidimensional assessment. Recommendations on the subtopic *education and training for RI* were brought up in natural and medical science groups. In discussions in both disciplines it was highlighted that funders can have a role in making training on good research practices mandatory in RPOs. The issue of senior researchers taking part in such training was highlighted in medical science groups. For the last subtopic, *processes for investigating allegations of research misconduct*, similar recommendations were brought up in discussions in the social and medical sciences. Both state institutional (RPO) policies need to be in place to deal with RM.

(Sub)topic	Theme	Humanities	Social sciences	Natural sciences	Medical sciences
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Funders expectations of RPOs	Policies in place at the RPO that receive funding	Funders requiring RPOs to document that RI/RE policies are in place and implemented within the institution	Build up national systems for checking if the right RI structures are in place at the RPOs (something like the Netherlands' Board on Research Integrity (LOWI))	Funders must discuss their codes and guidelines with RPOs before implementing them	No specific recommendation
	Reflection on research practices	No specific recommendation	Funders creating awareness and encouragement for researchers to reflect upon their research practices	No specific recommendation	No specific recommendation
	Control systems	No specific recommendation	No specific recommendation	No specific recommendation	Controlling randomly selected research projects from time to time
Codes of conduct		No specific recommendation	No specific recommendation	No specific recommendation Problem statement: CoCs should be seen as living documents by RFOs, not as black and white legal entities. CoCs should help researchers in their daily practice.	No specific recommendation
Assessment of researchers		No specific recommendation	Move away from box checking to stimulating change and good practices	No specific recommendation	No specific recommendation

Education and training for RI	Requirements from funders	No specific recommendation	No specific recommendation	Funders' can require teaching in good scientific practice	RI training in institution a requirement to apply for funding
	Senior researchers	No specific recommendation	No specific recommendation	No specific recommendation	Make it part of senior researchers contract with funders to take part in RI training
Processes for investigating allegations of research misconduct		No specific recommendation	Funders make sure that recipient organisations have RI mechanisms in place, e.g. whistleblower-protection	No specific recommendation	Institutional procedures for dealing with misconduct a requirement to apply for funding

Table 26: Recommendations that emerged during the focus groups for the topic funders expectations of RPOs. The table specifies the different topics and subtopics, with recommendations categorized under themes. These themes emerged during the focus groups, and portray similarities, new insights or differences for such themes.

Implications for the toolbox

Interestingly the topic generated quite similar recommendations across the disciplines. There are some recommendations that appeared in discussions in specific disciplines only, but we consider these recommendations applicable to other disciplines as well (such as demanding seniors to partake in RI-training). The outcomes of this topic imply that a generalized approach can be taken in the toolbox for this topic.

3.1.3.4 RFO Topic 4: Selection and evaluation of proposals

4	Selection & evaluation of proposals	a. RI plan b. methodological requirements c. plagiarism d. diversity issues
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Table 27: Overview of topics and subtopics for 'selection and evaluation of proposals'

The fourth RFO topic, **selection and evaluation of proposals** consists of four diverse subtopics. Various general recommendations were provided by the disciplines covering the general topic of how proposals are selected and evaluated. Especially in the natural sciences and humanities many recommendations were formulated. In the natural sciences, it needs to be noted there is no consensus among the focus group participants about the recommendations provided here, such as whether an RI-plan should be approved before funding. An RI-plan is something within a proposal that tells the RFO how the proposal and the study will deal with RI-issues. The identified themes include how proposals are assessed, what is required in a proposal, the use of reviewers, proposal evaluators, humanities specific recommendations and 'other'. As the recommendations are explained in the table below, we will cover a few examples. For example, the social sciences stress the importance of reflection on RI issues, and the medical sciences state that reflection on publication and research outputs is important. Moreover, the humanities state RI requirements should be in the proposal. Interestingly the humanities had their own discipline specific recommendation of increasing expert knowledge on RI in selection committees, and in that regard, it seems that they ask for some specific actions for their area of research. The subtopic *RI plan* raised several recommendations. The humanities discussed that the EU could act as a front-runner, which would stimulate change on international and national level to make RI plans mandatory in funding applications. The medical sciences, had a complementary recommendation of having a special place in a proposal dedicated to providing details on RI aspects of a proposal. Recommendations for the second subtopic, *methodological requirements*, was only brought up in a medical science group. It was suggested that funders can require DMPs. The third subtopic, *plagiarism*, did not appear much in the discussions in any disciplines and no recommendations came up. Regarding the fourth subtopic, *diversity issues*, two different recommendations came up in the social and medical science group discussions. The social sciences' recommendation states research should have impact for different groups in society, which should be detailed in the grant proposal. The medical sciences state research teams need to be diverse and account for how to ensure diversity.

(Sub)topic	Theme	Humanities	Social sciences	Natural sciences	Medical sciences
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Selection and evaluation of proposals	Assessment of proposals	Transparency in selection and evaluation procedures, processes, agendas and interests should be a strong focal point Broader conception of measurability and impact for the humanities	RFOs must emphasize originality of research ideas	Implementation of blind evaluation procedures and less focus on CVs and metrics that result in exclusion and potentially QRPs	No specific recommendation
	Reviewers	Expertise from the humanities could be increased in selection committees	RFOs need to give clear instructions to reviewers	Greater use of reviewers that academically are close to the application topic, for instance by increasing the use of international reviewers	No specific recommendation
	Proposal evaluators	No specific recommendation	No specific recommendation	Implementation of an evaluation of proposal evaluators (and sanctions for unaccountability)	No specific recommendation
	Proposal requirements	Include RI requirements in proposal	Avoid tick-box exercises and stimulate reflection on RI issues	RFO application requirements should allow for project specific clarifications	Make reflections on publications and output a part of the application
	Other	A more careful selection and distinction of important vs. less important application elements	No specific recommendation	Reviews and evaluations should include potential RI issues and other sensitive issues.	No specific recommendation

RI-plan	How to implement RI plan?	The EU Commission could act as front-runners. Change in RI practice and culture would possible influence national and institutional procedures.	Very firm and approved RI plans are not necessary before awarding the grant, adjustments can be made after the grant is awarded. Requirements for RI considerations should allow for disciplinary differences within social science	No specific recommendation	Make special places in application platform for addressing relevant RI issues in the specific research project
	Reflection	No specific recommendation	RI reflections afterwards in first deliverable from granted project & Stimulate self-reflections of proposals	No specific recommendation	No specific recommendation
Methodological requirements		No specific recommendation	No specific recommendation	No specific recommendation	Funders ask for data management plans for individual research projects
Plagiarism		No specific recommendation	No specific recommendation	No specific recommendation	No specific recommendation
Diversity issues	Gender composition	No specific recommendation	Funders setting standards for gender and other social justice balance issues – what the research means for those groups	No specific recommendation	Reflections on gender composition of research team would be good, but be careful with quotas

Table 28: Recommendations that emerged during the focus groups for the topic selection and evaluation of proposals. The table specifies the different topics and subtopics, with recommendations categorized under themes. These themes emerged during the focus groups, and portray similarities, new insights or differences for such themes.

Implications for the toolbox

A huge variety of recommendations was put forward for the topic **Selection and evaluation of proposals** and its subtopics across all main areas of research. Each main area of research came up with several recommendations in their individual discussions as highlighted in table 27 above. Still, all or most of them are generic ideas that probably also are relevant to other main areas of research. Many of these recommendations can be taken up in the toolbox. However, there are some discipline specific recommendations; the humanities specific recommendations should be developed in the toolbox to meet the needs of the humanities.

3.1.3.5 RFO Topic 5: Research Ethics Structures

5	Research ethics structures	a. research ethics requirements b. ethics reporting requirements
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Table 29: Overview of topic and subtopics for 'Research ethics structures'

The topic **research ethics structures** comprise the two subtopics '*research ethics requirements*' and '*ethics reporting requirements*'. The different disciplines discussed that in general, RE is the task of the RPO. Nonetheless, in line with the various recommendations, the funder can play a role in incentivizing RE. One general theme was identified on the topic research ethics structures; guidelines. The social sciences underline the importance of good guidelines on when ethics approval should be sought and which issues should be considered. The medical sciences' recommendation specifies that approval should be obtained or guaranteed in the grant proposal when applying for a grant. Moreover, the humanities provided a discipline specific recommendation, specifying that a difference in ethical approval should be possible when considering vulnerable versus non-vulnerable populations. The first subtopic, *research ethics requirements* was only discussed by the social sciences. Their recommendations cover that the RFO require details on what the responsibilities of RPOs are and how funders can ensure ethical structures are in place and approval is sought. In addition, a national ethics body should oversee industry collaborations. The second subtopic, *ethics supporting requirements* yielded a diverse set of recommendations. The humanities stated clear guidelines from IRBs could diminish the need of RFOs to monitor the RE structures. The medical sciences' recommendation included the ideas of having specific sections in a proposal to elaborate on research ethics issues, and dedicate a section related to the topic of interest.

(Sub)topic	Theme	Humanities	Social sciences	Natural sciences	Medical sciences
Research Ethics Structures	Guidelines	Awareness and consideration of the difference between vulnerable populations and non-vulnerable populations	Make clear and simple guidelines for when to apply for ethical approval and guidelines for how to consider ethical issues in your research	No specific recommendation	RFOs could have policies in place that ensure that all ethical approvals are obtained (<i>and specified in the grant proposal</i>). If these are not obtained, the project will probably need to be adjusted and a plan B initiated.
Research Ethics Requirements	Ethics structures at RPOs	No specific recommendation	Funders make sure that recipient organisations have ethics observing mechanisms and funders can require ethical reviewing of research within the RPO to obtain the grant	No specific recommendation	No specific recommendation
	Ethics and public/private research	No specific recommendation	National ethics bodies for industry research and independent researchers	No specific recommendation	No specific recommendation
Ethics Supporting requirements		Clear and transparent systems of ethical institutional review boards (IRBs) could reduce the need for RFO monitoring and/or release resources for	No specific recommendation	No specific recommendation	Online funding applications could provide an opportunity for ethical specifications related specifically to the topic of interest, e.g. clinical experiments.

		own RFO ethical procedures			
					Ethical considerations should have its own dedicated space for elaboration in the funding application

Table 30: Recommendations that emerged during the focus groups for the topic research ethics structures. The table specifies the different topics and subtopics, with recommendations categorized under themes. These themes emerged during the focus groups, and portray similarities, new insights or differences for such themes.

Implications for the toolbox

The topic **Research ethics structures** raised many useful recommendations. The funders can clearly play a role in incentivizing RE, and ensuring that appropriate structures are in place at the RPO level. For example, RPOs must have clear guidelines in place for *when* researchers need to apply for ethical approval and for *how* they exactly do that. Here, disciplinary differences also have to be taken into account, especially for the humanities.

3.1.3.6 RFO Topic 6: Collaboration within funded projects

6	Collaboration within funded projects	a. expectations on collaborative research b. research that is co-financed by multiple funders
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Table 31: Overview of topics and subtopics for 'collaboration within funded projects'

Only the medical and social sciences provided several recommendations on the topic **collaboration within funded projects**. The humanities, for instance, did not consider the topic as very important. However, they did briefly discuss the image funders have about interdisciplinary projects involving the humanities, which should be more positive. The social sciences' recommendation specified the need for management plans. Within large collaborations it should be clear who can be contacted for which issues. In addition, rules and regulations differ greatly between countries, and within collaborations the country with the least bureaucratic rules was usually sought out to comply to, rather than the country with the most complex or complicated rules. The medical sciences had a similar discussion. Their recommendation included the need to align requirements, and to comply with the highest standards within such collaborations. The natural sciences also recognized this problem; however, their emphasis lay with the responsibility of the RPO where the research is conducted to have such structures in place. Regarding *research co-financed by multiple funders*, the medical sciences again emphasized the need for researchers to follow the highest standards, irrespective of the institution or country. RFOs could incentivize following high standards by including this in their guidelines. In addition, common grant schemes could simplify the procedures for researchers.

Subtopic	Theme	Humanities	Social sciences	Natural sciences	Medical sciences
Expectations on collaborative research	None	No specific recommendation	Need for management plans	A funder's role could be to check that there is a sound management structure around granted projects and that the project manager is properly trained	Alignment on requirements, e.g. the highest standards asked for among the collaborators

Research that is co-financed by multiple funders	None	No specific recommendation	No specific recommendation	No specific recommendation	<p>Researchers should live up to highest standards asked of them (in case they encounter different standards) and make funders aware of conflicting requirements.</p> <p>Common grant schemes e.g. within EU</p>
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Table 32: Recommendations that emerged during the focus groups for the topic collaboration within funded projects. The table specifies the different topics and subtopics, with recommendations categorized under themes. These themes emerged during the focus groups, and portray similarities, new insights or differences for such themes.

Implications for the toolbox

This topic raised few recommendations, however, the common problem of following the highest standards in cross-boundary collaborations was discussed in three out of four disciplines. The medical sciences' recommendation that the highest standards should be followed in case of different standards could be taken up in the toolbox. The natural sciences stress the responsibility of the RPO regarding this topic, which can be taken up as a general recommendation.

3.1.3.7 RFO Topic 7: Monitoring of funded applications

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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Table 33: Overview of topics and subtopics for ‘monitoring of funded applications’

The topic **monitoring of funded applications** has three diverse subtopics: ‘*financial monitoring*’, ‘*monitoring of the execution of the research grant*’ and ‘*monitoring of compliance with RI requirements*’. Hence, the topic also has a diverse and divergent set of recommendations. Interestingly, the medical sciences did not provide any specific recommendations. Several general recommendations were also made regarding monitoring. The humanities and social sciences provided similar recommendations on monitoring, stating monitoring should be flexible (as much or little as necessary for a project) and to avoid ‘tick boxing’. Moreover, alignment in requirements could ease the administrative burden. Only the social sciences provided concrete recommendations on financial monitoring, which stated that RPOs should have oversight bodies in place for financial monitoring and compliance with audit requirements. Regarding the execution of the research, and potential financial consequences for deviations in the research project, various disciplines stressed that changes to the initial plan were always possible, and monitoring should be open to changes. The social sciences translated this to the recommendation of creating a specific output justifying the changes. However, the natural sciences stated research outputs should be specified beforehand providing more clarity. The third subtopic, compliance with RI requirements has concrete recommendations from the humanities and natural sciences. The humanities highlighted that boards who have expertise in integrity should check the compliance. The experts could consequently send their findings to the funders. Lastly, the natural sciences provided the idea of implementing ex-ante reflections and evaluations on RI in grant applications.

Subtopic	Theme	Humanities	Social sciences	Natural sciences	Medical sciences
Monitoring of funded applications	Monitoring	Avoid monitoring for monitoring’s own sake and avoid meaningless checkboxes	Monitor adequately – as much as necessary or as little as necessary	No specific recommendation	No specific recommendation
	Requirements	Divide work between RFOs and RPOs – who monitors what?	Create alignment in requirements	No specific recommendation	No specific recommendation

Financial monitoring	None	No specific recommendation	RPOs should have mechanisms overseeing the use of funds Monitoring of compliance with auditing requirements, but no more than that.	No specific recommendation	No specific recommendation
Monitoring of execution of research grant	None	No specific recommendation	In case of major changes to plan, some sort of output to explain why the research didn't turn out as planned	Clarifications of output expectations beforehand and simplicity and clarity in the final reporting	No specific recommendation
Monitoring of compliance with RI requirements	None	Should be checked by people who have the expertise to do this, e.g. by IRBs – who could then send their decision to the funders	No specific recommendation	Ex-ante reflections and evaluations on RI in grant applications	No specific recommendation

Table 33: Recommendations that emerged during the focus groups for the topic education and training. The table specifies the different topics and subtopics, with recommendations categorized under themes. These themes emerged during the focus groups, and portray similarities, new insights or differences for such themes.

Implications for the toolbox

This topic has many generic recommendations. However, the recommendations of the social and natural sciences regarding the monitoring of the execution of the research grant are somewhat different, and (perhaps) require different approaches in the toolbox. It looks like, in the natural sciences things should be already planned and there is less room for change, while in the social sciences changes/deviations are more acceptable, although they have to be described well.

3.1.3.8 RFO Topic 8: implementing and updating RI-policy

8	Implementing and updating RI-policy	None
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Table 34: Overview of the topic 'implementing and updating RI policy'. No subtopics are specific for this topic.

The topic RI policy, with the subtopic implementing and updating RI-policy only specifies the recommendation given by the medical sciences, which is to ensure the appropriateness of policies is regularly checked.

Subtopic	Theme	Humanities	Social sciences	Natural sciences	Medical sciences
Implementing and updating RI-policy	None	No specific recommendation	No specific recommendation	No specific recommendation	Check regularly if policies are still appropriate

Table 34: Recommendations that emerged during the focus groups for the topic implementing and updating RI-policy. The table specifies the different topics and subtopics, with recommendations categorized under themes. These themes emerged during the focus groups, and portray similarities, new insights or differences for such themes.

Implication for the toolbox

The recommendation of checking regularly if policies are still appropriate could be turned into a guideline that covers all RFOs, no matter which disciplines they cover.

3.1.3.9 RFO Topic 9: Independence

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
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Table 35: Overview of topics and subtopics for 'Independence'

The topic **independence** covers the subtopics *unjustifiable interference*, and its prevention by funders, political or commercial influences. The first subtopic covers *what counts as unjustifiable interference*. The focus groups of the humanities stated that specifying and ensuring academic freedom, with the use of guidelines, is important. The second subtopic concerns *preventing interference by the funder*. The social sciences stress the importance of transparency prior to a research project, while the medical sciences provide the distinct approach of only letting funders interfere in case of serious wrongdoing. The third subtopic, preventing interference by political or other parties did not result in recommendations from any discipline. The last topic, unjustifiable interference by commercial influences only resulted in a recommendation from the natural sciences. Their recommendation specifies that guidelines should be in place to ensure research integrity in public-private collaborations, in particular this should be specified in the funding contracts.

Subtopic	Theme	Humanities	Social sciences	Natural sciences	Medical sciences
What counts as an unjustifiable interference?		Specifying and ensuring academic freedom through guidelines	No specific recommendation	No specific recommendation	No specific recommendation
Preventing unjustifiable interference by the funder		No specific recommendation	Be transparent about funding sources and signing agreements up front with funders	No specific recommendation	Funders should only interfere post-grant if something goes badly wrong
Preventing unjustifiable interference by political or		No specific recommendation	No specific recommendation	No specific recommendation	No specific recommendation

other external influences					
Preventing unjustifiable interference by commercial influences		No specific recommendation	No specific recommendation	Guidelines on ensuring RI in collaborations with industry before signing funding contracts.	No specific recommendation

Table 36: Recommendations that emerged during the focus groups for the topic independence. The table specifies the different topics and subtopics, with recommendations categorized under themes. These themes emerged during the focus groups, and portray similarities, new insights or differences for such themes.

Implications for the toolbox

For this topic, the social and medical sciences have differing views on preventing unjustifiable interference by the funder. The social sciences specify that this should be considered before the research, where the medical sciences states that only when something has gone wrong, this should be looked into by the RFO. However, having a good grant agreement before the start of the research is essential to satisfy the recommendations from both disciplines. Therefore, a generalized approach can be taken on this in the toolbox. Moreover, the other recommendations about academic freedom and the use of guidelines that ensure RI in collaborations with industry can be seen as more general, and can be taken up in the toolbox with a more generic approach.

3.1.3.10 RFO Topic 10: Publication and communication

9	Publication and communication	a. publication requirements b. expectations on authorship c. open science (open access, open data, transparency)
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Table 37: Overview of topics and subtopics for ‘publication and communication’

The topic **publication and communication** led to elaborate discussions in all four disciplines. Various disciplines agreed that funders are in a key position to change the current system of publication, authorship and open science. Various recommendations came out of the discussions around the first subtopic, *publication requirements*. The social sciences underlined the importance of having good guidelines in place to emphasize quality of research over quantity. A second covered theme was research outputs. Both the social and natural sciences state negative results should be acknowledged by funders, and should also be published. Moreover, the humanities’ recommendation specifies funders need to accept realistic research outputs to create space for good research practices. The medical sciences’ recommendation included describing the relevant and realistic expected research outputs in the grant applications. The second subtopic, *expectations on authorship*, led to various recommendations from the different disciplines. For instance, the social sciences recommend to let researchers reflect on authorship issues in advance, specifically to take disciplinary differences into account. Moreover, the natural sciences found it important to do something about gift authorship practices. The third topic, *open science*, resulted in many recommendations, of which a few will be described here (for a full overview, see the table below). The role funders have related to RI and open science practices was thought to be large. For example, when considering the financial side of open access publishing, funders could influence the system by denying to pay for gold open access, which is what the natural sciences stated. The medical sciences’ recommendation specified that funders should be facilitating open access publications, and may have to pay the open access fee. In addition, the humanities and social sciences describe the role of guidelines for the use of open science practices. The focus groups showed that not least the humanities would benefit from discipline specified guidelines to deal with the distinct types of data and challenges different disciplines face on the road to open science. Data sharing and finding data was discussed in several disciplines and must be taken up in the toolbox. Lastly, one idea of the medical sciences was to train young researchers in responsible open science practices.

Subtopic	Theme	Humanities	Social sciences	Natural sciences	Medical sciences
Publication requirements	Guidelines	No specific recommendation	Have good guidelines for reviews of applications, papers etc. (to increase the quality over quantity)	No specific recommendation	No specific recommendation
	Research outputs	Have realistic expectations of research output Making your data openly available should be recognized as an important output	Clause in calls stating that negative results are of equal value	All negative results must be published	RFOs ask researchers in their project descriptions/applications to outline their view on relevant outputs
Expectations on authorship	Policies and requirements	No specific recommendation	Requirement for reflection on authorship issues in application to account for disciplinary differences	Funders having guidelines on authorship contribution like journals	Draft publication policies in advance
	Culture	No specific recommendation	No specific recommendation	Need to get rid of gift authorship culture	No specific recommendation
Open science (open access, open data, transparency)	Data sharing	Develop intelligent search systems to find data	No specific recommendation	Ensure data publicly in databases if possible	Make it obligatory to share data
	Funding of OA	No specific recommendation	No specific recommendation	Funders' refuse to pay journals Golden Open Access fees – allowing for the system of OA to change	RFOs give funding to the open access requirements they set

	Future and sustainability	Longevity plans/sustainability plans of research projects	No specific recommendation	No specific recommendation	Investments in open data procedures and infrastructure
	Guidelines	Disciplinary tailored guidelines within the humanities to account for need such as data sharing, openness, archiving etc.	Guidelines on open science procedures	No specific recommendation	No specific recommendation
	Other	Funders could provide information on similar funded projects to other beneficiaries that have received funding from the same funder	No specific recommendation	Research communities establish their own journals	Journals' prices should be scrutinized & train young researchers in open data

Table 38: Recommendations that emerged during the focus groups for the topic publication and communication. The table specifies the different topics and subtopics, with recommendations categorized under themes. These themes emerged during the focus groups, and portray similarities, new insights or differences for such themes.

Implications for the toolbox

The topic provided many good ideas for the future work on the toolbox. Guidelines are, for example, needed for valuing positive and negative results. The focus groups also showed that authorship requirements differ between disciplines, and that SOPs and guidelines therefore have to be differentiated to match the research practices of the different disciplines. Common for all disciplines is, however, that it should be clear beforehand what the authorship policies are. The recommendation from the natural sciences to get rid of gift authorships is also important, and funders can play a role in setting strict and discipline specific rules on authorship and contributions to research. The subtopic open access also requires a diverse approach for the different disciplines, although the common ground is that it should be as transparent as possible. All disciplines will benefit from a distinct set of discipline tailored tools dealing with data management practices, sharing and opening data and open access. Furthermore, there seems to be a need for guidelines for open access practices.

3.1.3.11 RFO Topic 11: Intellectual property issues

10	Intellectual property issues	NONE
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Table 39: Overview of the topic 'Intellectual property issues'. No subtopics are specified for this topic.

This discussion of this topic **Intellectual property issues** resulted in one recommendation from the natural sciences, that funders should not get involved in issues concerning intellectual property rights, which they believe RPOs can handle. However, they also pointed out that individual researchers often are uninformed about intellectual property rights. In addition, the main topics discussed related to IPR issues were authorship and plagiarism, which are already covered by other topics.

Subtopic	Theme	Humanities	Social sciences	Natural sciences	Medical sciences
Intellectual property issues		No specific recommendation	No specific recommendation	Funders should not get too involved in dealing with IPR issues, RPOs can handle this Researchers generally uninformed on IPR	No specific recommendation

Table 40: Recommendations that emerged during the focus groups for the topic intellectual property issues. The table specifies the different topics and subtopics, with recommendations categorized under themes. These themes emerged during the focus groups, and portray similarities, new insights or differences for such themes.

Implications for the toolbox

The recommendation from the natural sciences has to do with the division of work between RFOs and RPOs, which is something that future versions of the Toolbox need to consider carefully.

3.2 Heat maps

The sorting exercise in the focus group interviews in WP5, which are presented in a number of heat maps in D5.2., provided an overview of the different main areas of research's perception of the importance of the different topics. Here, we show the heat maps from D5.2 and draw conclusions on the basis of them.

Methodology for the heat maps

The heat maps of the importance of the 9 topics for the RPOs and the 11 topics for the RFOs were created by looking at the results of the sorting exercises and, when available, the transcriptions of the discussions during the exercise. In most cases, a card would be placed in a category by one participant. During the discussion, the group was able to provide feedback on each topic and nuance their position. These conversations have allowed us to provide a richer view of the priorities on RI topics.

The sorting exercise had three categories: very important, somewhat important, and of none or minimal importance. Participants were required to place each topic-card in one of them after discussing it with the group, however in some cases participants placed a card in between categories. Following this, a category was added in between each of the three named above, this addition also allowed us to reflect more on the outcomes of the discussions during the sorting exercises. The categories for the heat maps became: very important (dark green), important (light green), somewhat important (yellow), of minimal importance (orange), and not important (red).

Translating the results of the sorting exercises and the discussions into its visual form was done through two rounds of coding. In the first round, two researchers analysed the pictures and transcriptions in order to place each topic in one of the categories. This was done for each of the 30 groups. In the second round, disparities in the coding were analysed and discussed. To account for the disparities, the coding of the two researchers was given a number and averaged, where the lower category (not important) amounted for one point and the higher for 5 (very important).

The averages were translated into two graphics which are merged into a heat map per disciplinary field. The first graphic shows the average positioning of each topic per focus group while the second one shows the averages per topic for all the focus groups in one field. Both in the group and in the combined graphics, the averages of the two rounds of coding were calculated, thus on occasions the combined results might seem to differ between columns despite the appearance of the columns having the same values. The encompassing heat maps for RPOs and RFOs use the results per group shown in each discipline, but in the combined graphic the average for all RPOs or RFOs were considered.

3.2.1 Heat map Humanities RPO

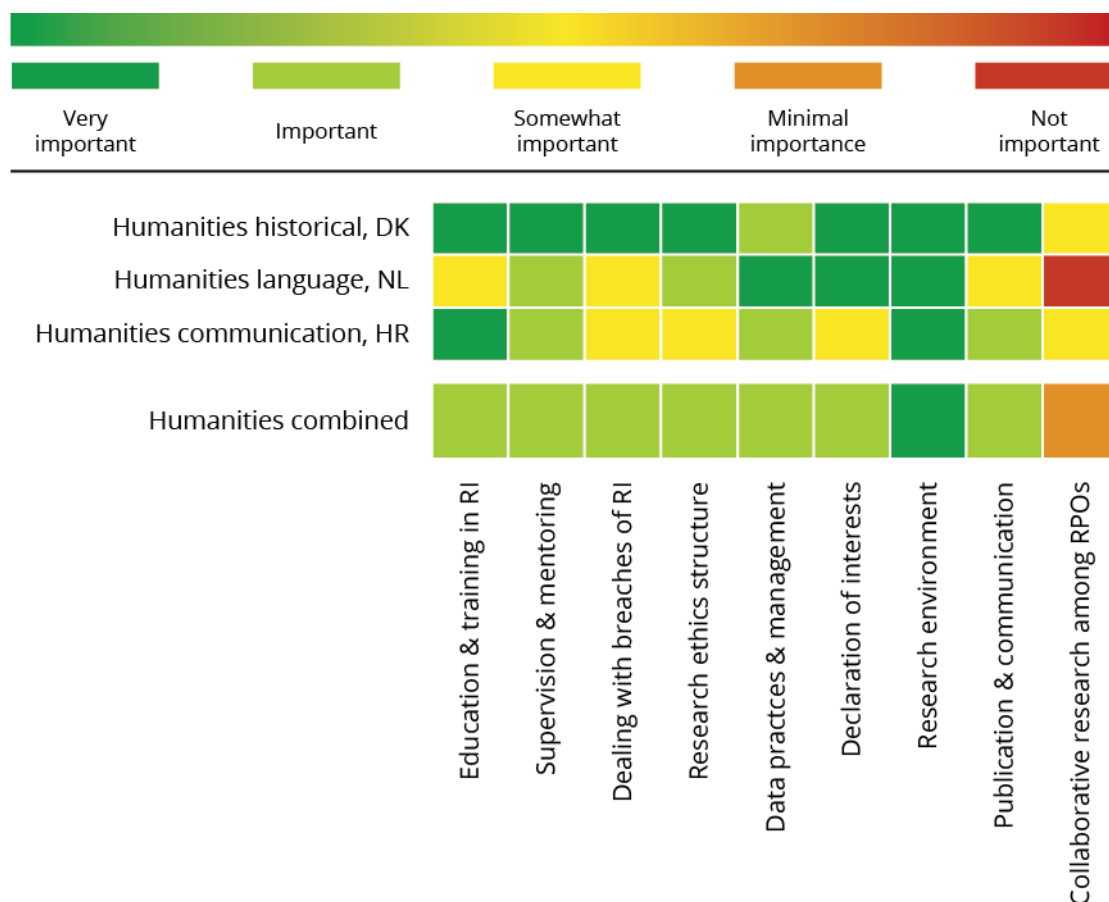


Figure 2: Heat map for the humanities RPO focus groups

This heat map shows the results of the sorting exercise during the focus group interviews. It reflects the importance assigned to specific topics by humanities researchers in relation to RPOs. Specifically, the map provides an overview of the areas where respondents perceived that guidelines and SOPs could support the RI efforts of RPOs. The stark differences in the scale in which topics were arranged can be explained through disciplinary research cultures, but also by past experiences of researchers concerning the implementation of specific measures which have been perceived as “fashionable”. Some researchers were reluctant to sort certain topics as very important in fear this would become “yet another ticking box”. The topic of research environment was unanimously chosen as very important due to its perceived influence to other topics. Although most of the other topics were considered as important, a few should be highlighted. For example, the topic of supervision and mentoring was seen as a basis to foster a solid research culture. The topics of research ethics structures and data practices were perceived very differently among the three groups owing to the experiences and needs of each disciplinary field. The latter was partly confused with GDPR, which

was considered as a topic not necessary of widespread efforts once the initial implementation has been adopted. Other topics that were seen as less important in the sense of receiving attention for guidelines and SOPs were publication and communication, and collaborative research among RPOs. The former is considered as already well regulated while the latter seems to be less of an issue for the humanities.

3.2.2 Heat map Social sciences RPO

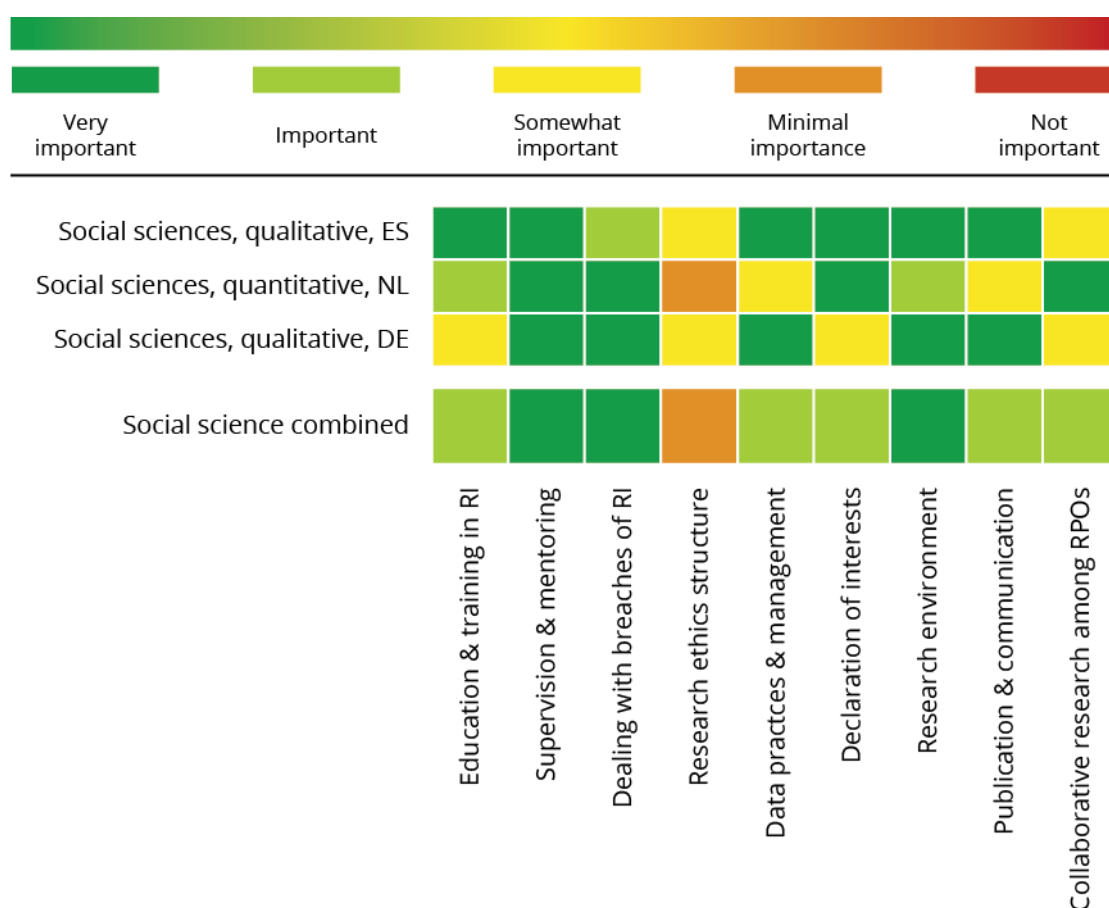


Figure 3: Heat map for the social sciences RPO focus groups

This heat map shows the results of the sorting exercise during the focus group interviews of social sciences researchers, and as such reflect the importance assigned to the single RPO-topics by them. The map provides an overview of the areas where respondents perceived that guidelines and SOPs could support the RI efforts of RPOs. The differences on the level of importance assigned can be explained through the different disciplinary research cultures and the specific research misconduct

cases that researchers in the social sciences have witnessed. A few topics deserve to be further explained. For example, education and training in RI were seen as important however the respondents noted the emphasis should be on integrating RI topics into existing courses and that specific RI guidance could better focus on supervision and mentoring. The heat map shows some peculiar results which could be seen as contradictory. For example, dealing with breaches of RI is seen as very important while the research ethics structures are less important. This sorting owes to the perceived need for improvement on the former topic while the latter was seen as already being well regulated. Similarly, to other groups, the research environment was seen here as pivotal for regulating other areas such as declaration of competing interest. Finally, the topic of data practices and publication and communication were also highlighted as an issue which could benefit from better guidance.

3.2.3 Heat map Natural science RPO

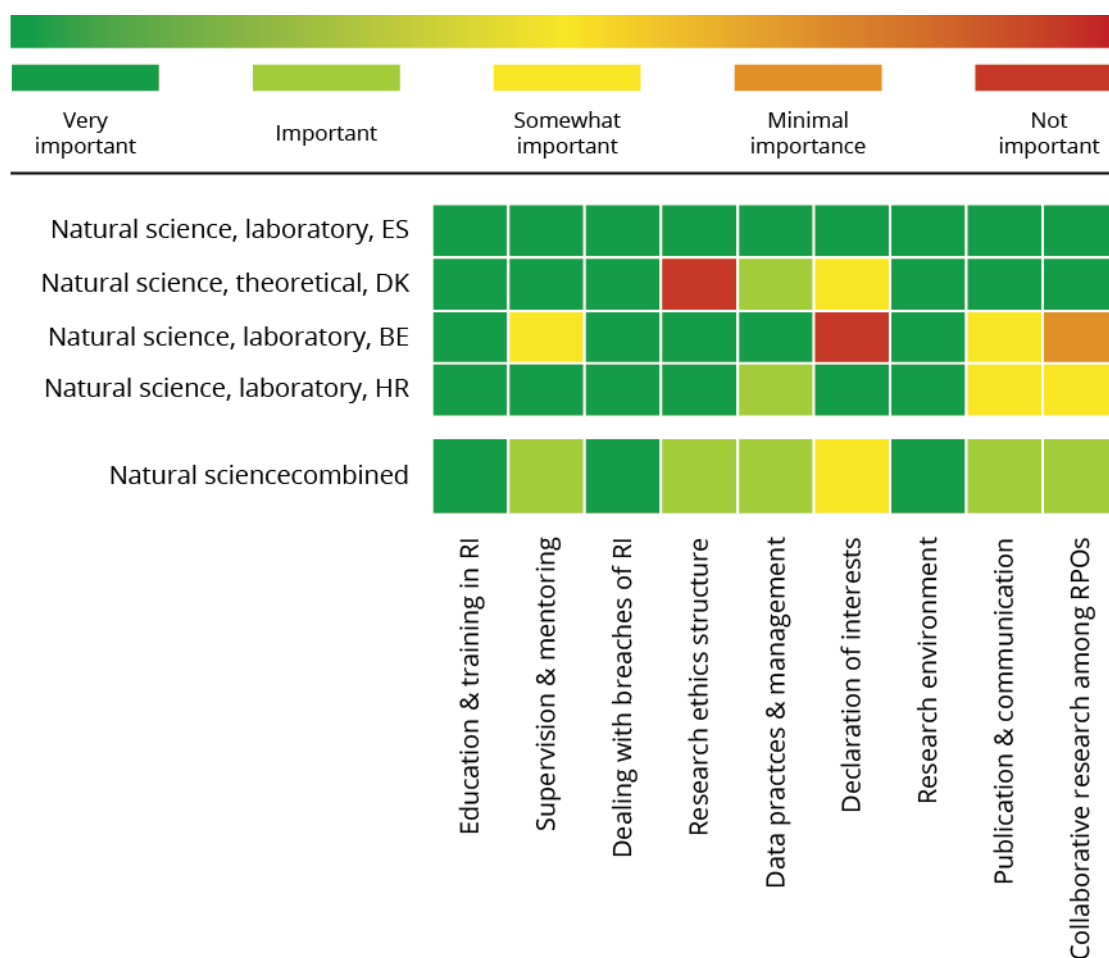


Figure 4: Heatmap of the natural sciences RPO focus groups

This heat map shows the results of the sorting exercise for the natural sciences. It reflects the importance assigned to specific topics in relation to research integrity. Specifically, the map provides an overview of the areas where respondents perceived that guidelines and SOPs could support the RI efforts of RPOs. The topics marked as very important do not necessitate further explanation. Some of the topics marked as important were in general seen as relevant but there was discussion on whether guidelines are possible such as for supervision and mentoring and collaborative research among RPOs. Other important topics are seen as already receiving enough attention such as research ethics structures, data practices, and issues surrounding publication and communication. Finally, the declaration of competing interests was perceived very differently across the groups, while for some it is a practice well-handled, others wondered what the effect is of having such declarations.

3.2.4 Heat map Medical science RPO

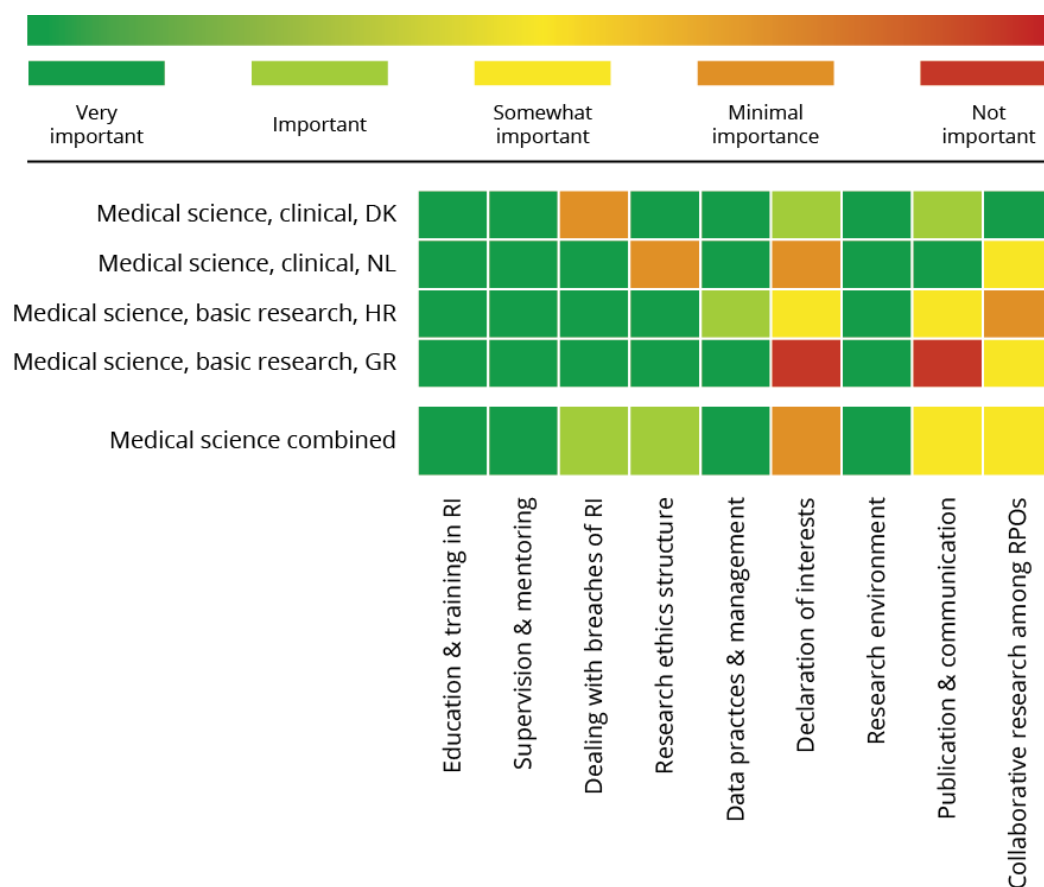


Figure 5: Heat map of the medical sciences RPO focus groups

This heat map shows the results of the sorting exercise during the focus group interviews for the medical sciences. It reflects the importance assigned to specific topics in relation to research integrity. Specifically, the map provides an overview of the areas where respondents perceived that guidelines and SOPs could support the RI efforts of RPOs. The arrangement of the topics shows some differences. From the topics perceived as very important, education and training in RI, data practices, and the research environment were highlighted as cornerstones that also affect other areas. The research ethics structure and dealing with RI breaches were perceived as being an integral part of the research environment and therefore not assessed as very important. The latter was also seen as already being well-handled. Similarly, to the perception in the natural sciences, the declaration of competing interests was seen as being a mere formality. Publication and communication and collaborative research with RPOs were seen as somewhat important in relation to the other topics but nevertheless seen as relevant by the clinical medicine groups.

3.2.5 Heat map RPOs



Figure 6: heat map of the combined focus groups for RPO topics.

This heat map provides an overview of the sorting exercises for all RPOs focus group interviews. Although each discipline and field will perceive the RI needs differently, there are a couple of topics, which are seen as very important across disciplines: supervision and mentoring, and the research environment. Specifically, the topic of the research environment seems to be a constant across all groups and an area that definitely deserves attention. While most of the other topics are seen as important, two topics stand out as being considered less important. The declaration of interests is largely seen as a formality that is not monitored properly while collaborative research among RPOs seems to be less of a concern for most disciplines.

3.2.6 Heat map Humanities RFO

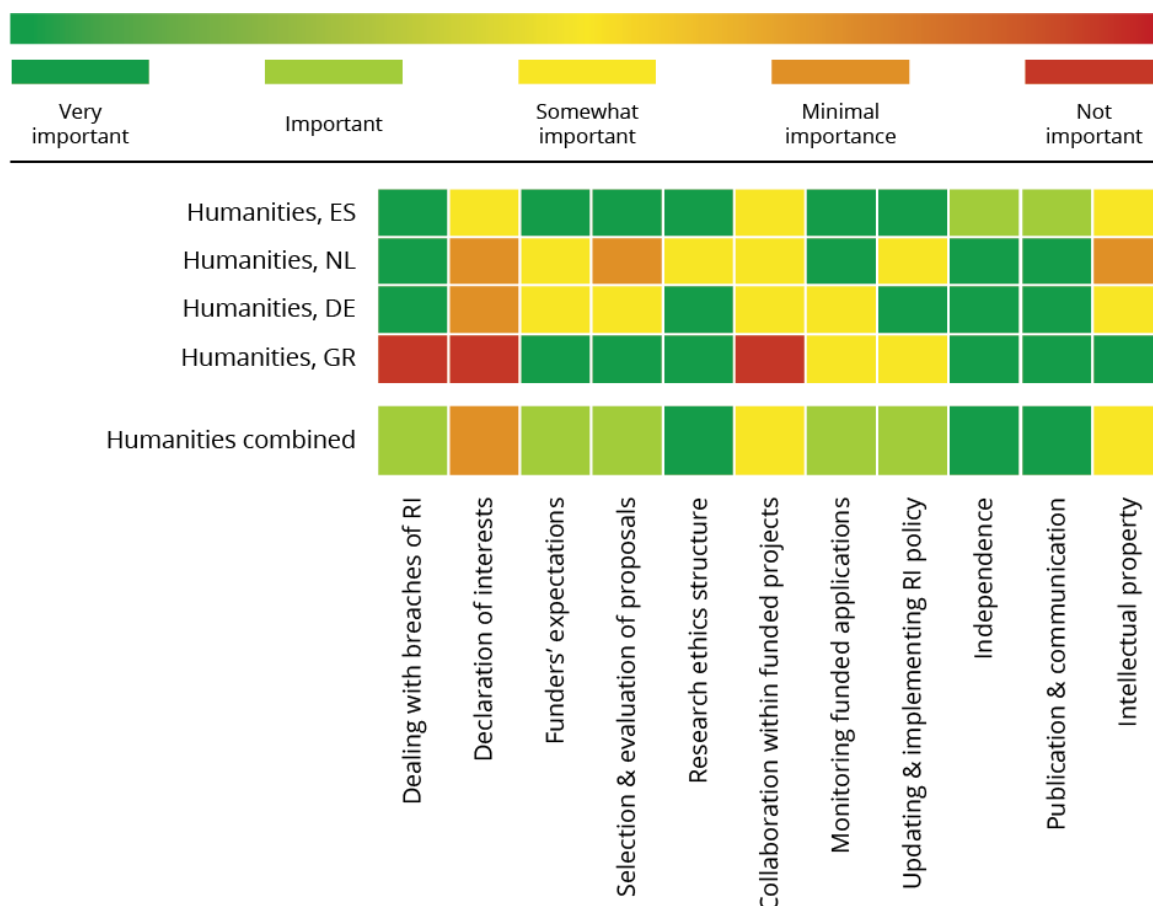


Figure 7: heat map of the humanities RFO focus groups

This heat map shows the results of the sorting exercise during the focus group interviews for the stakeholder and researcher groups from the humanities. It reflects the importance assigned to specific topics in relation to research integrity. The map provides an overview of the areas where respondents perceived that RFOs could support the RI efforts of RPOs. There are a few topics where it is clear that guidelines and SOPs could be useful such as research ethics structure, independence, and publication and communication. In general, respondents were concerned with a raise in bureaucracy and often did not agree that RFOs should be involved in certain topics such as dealing with breaches of RI. For other topics it was felt that good measures were already in place, such as in declaration of competing interests. Finally, independence and collaboration within funded projects seems to be not so important for the humanities.

3.2.7 Heat map Social sciences RFO

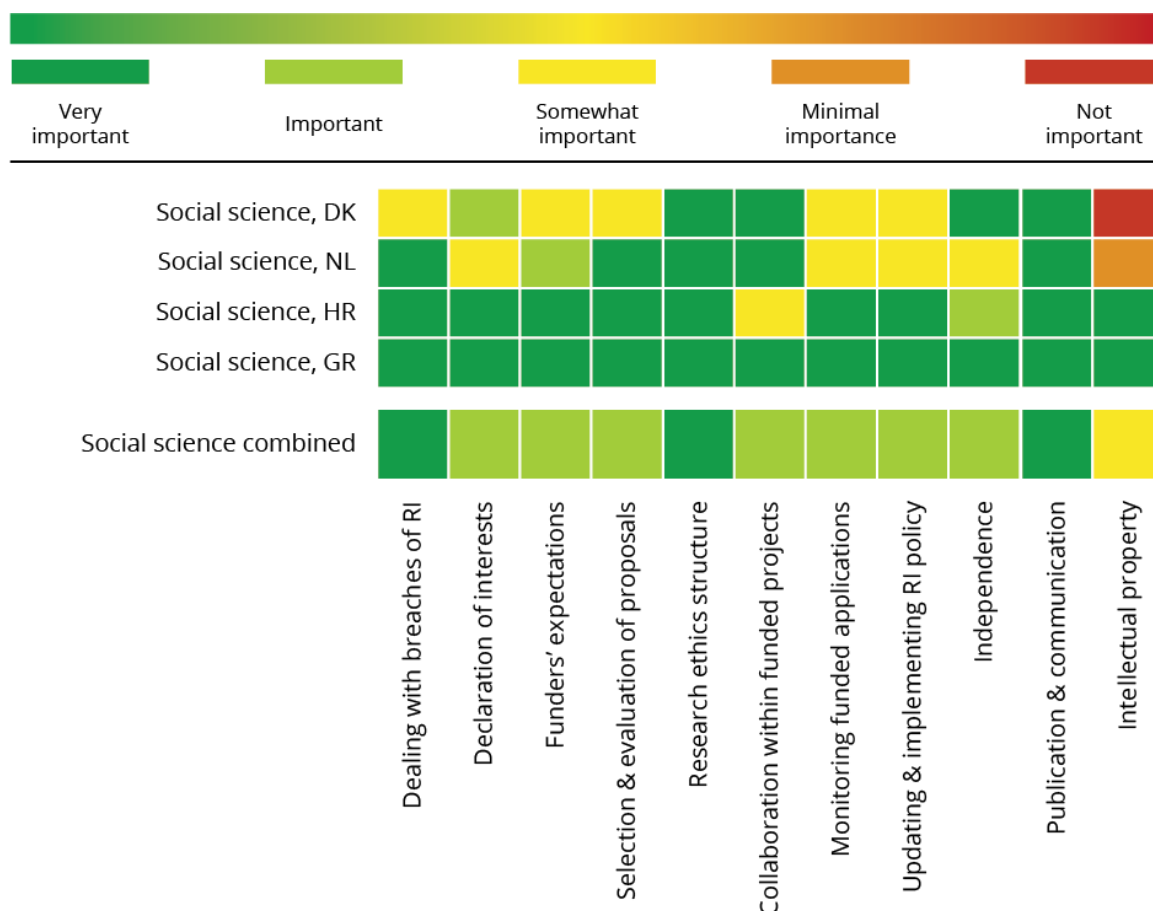


Figure 8: heat map of the social sciences RFO focus groups

This heat map shows the results of the sorting exercise during the focus group interviews for the stakeholder and researcher groups from the social sciences. It reflects the importance assigned to specific topics in relation to research integrity. The map provides an overview of the areas where respondents perceived that RFOs could support the RI efforts of RPOs, specifically important are research ethics structure, publication and communication and dealing with breaches of RI. This last topic has only been prioritized in this discipline for all the RFOs, which can owe to the recent experiences on misconduct that have rocked the field. While most of the topics have been sorted as important there were distinctions on how they are perceived. For example, funders expectations and the selection and evaluation of proposals, were both seen as topics where there could be a positive contribution from RFOs. While collaboration within funded projects and monitoring funded applications were seen as redundant and contributing to an increase in red tape/bureaucracy.

3.2.8 Heat map Natural science RFO

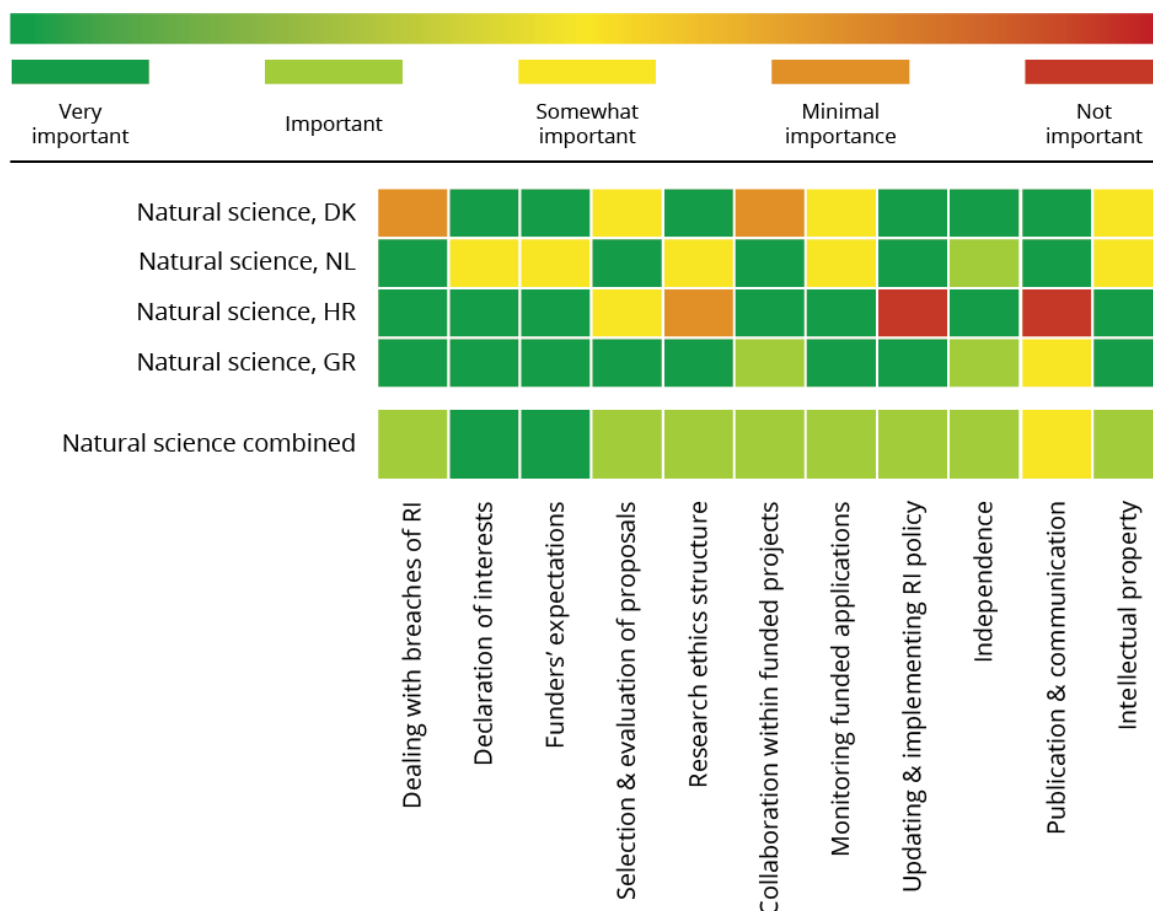


Figure 9: heat map of the natural sciences RFO focus groups

This heat map shows the results of the sorting exercise during the focus group interviews for the stakeholder and researcher groups from the natural sciences. It reflects the importance assigned to specific topics in relation to research integrity. Specifically, the map provides an overview of the areas where respondents perceived that RFOs could support the RI efforts of RPOs. While the topics that demand the most attention are clear, those marked as important deserve some nuancing. For some topics such as dealing with breaches of RI and research ethics structure, the general feeling was that this is a responsibility of RPOs. Having tools for the selection and evaluation of proposals was seen as a positive contribution as it would make procedures more transparent and fairer. Finally, independence was deemed important as a topic, but the range of actions for RFOs on this as well as its influence on research integrity were questioned during the sorting discussions.

3.2.9 Heat map medical science RFO

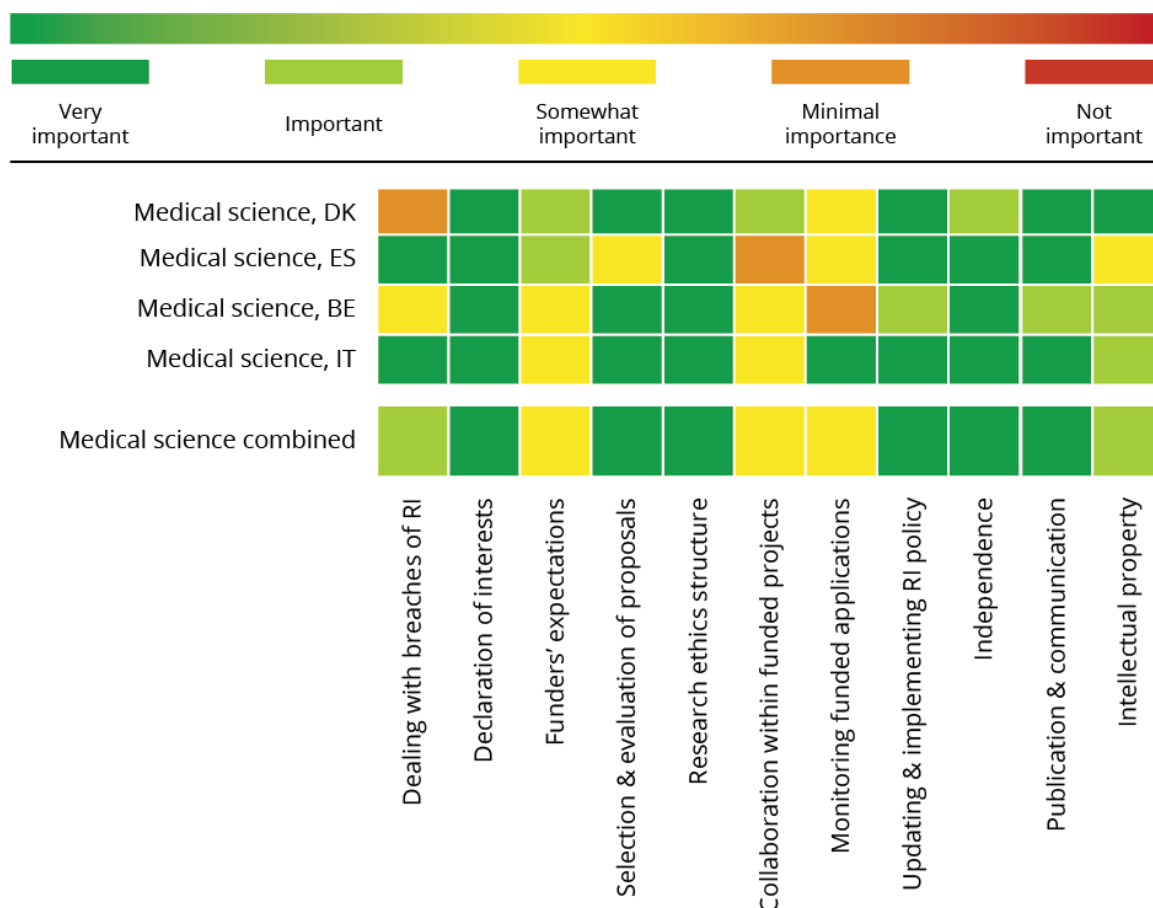


Figure 10: Heat map of the medical sciences RFO focus groups

This heat map shows the results of the sorting exercise during the focus group interviews for the stakeholder and researcher groups from the medical sciences. It reflects the importance assigned to specific topics in relation to research integrity. Specifically, the map provides an overview of the areas where respondents perceived that RFOs could support the RI efforts of RPOs. From the eleven topics, six were deemed as areas where RFOs could contribute positive to RI efforts in research culture. As noted for other disciplines, respondents noted that there must be a balance on the responsibilities between RPOs and RFOs. Thus, for some topics such as research ethics structure, independence, updating and implementing RI policy, and publication and communication, RFOs should not interfere with the internal affairs of RPOS but should demand that there are mechanisms in place. While for others such as declaration of competing interests, and selection and evaluation of proposals involve the work of the RFOs themselves. Finally, the three topics marked as somewhat important were seen as difficult to implement and follow effectively.

3.2.10 Heat map RFOs



Figure 11: Heat map of the combined RFO focus groups

This heat map provides an overview of the sorting exercises for all RFOs focus group interviews. Unlike in the overview for RPOs, there is no clear topic which is seen widely as very important. However, the overview allows for an identification of a few topics that were sorted more often under very important such as dealing with breaches of RI, research ethics structure, and publication and communication. The wide gaps between how topics were sorted along all these groups can owe to the confusion on whether the responsibility of guidelines and SOPs would fall back onto more red tape for RPOs. Each group sorting also reflects the regional and disciplinary needs and experiences. Finally, collaborating within funded projects and intellectual property are clearly seen as less important than the others, specifically in the context of research integrity and the relation between RFOs and RPOs.

3.3 Incorporating the results of WP5 - Introduction

In section 3.1 we described the disciplinary differences and similarities of the focus groups per topic for both RPOs and RFOs. At the end of each topic implications for the toolbox were given. In section 3.2 we described the results of the heat maps ranking the topics in order of importance. In the following section we will specify if a generic approach or different approach should be taken in the toolbox. This will also be determined by the outcomes of the heat maps.

3.3.1 Incorporating the results of WP5 into the second version of the toolbox

The section is a schematic overview of the topics, their subtopics, the approach to the recommendations and the importance as based on the heat maps of WP5. This schematic overview should be seen as a summary providing the most important recommendations. The overview specified whether a general approach, or discipline specific approach is warranted. **Please see section 3.1 for a full and elaborate overview of the recommendations, for which discipline the specific approaches are necessary and an elaborate specification of the general approach.**

3.3.2 Schematic overview of RPO topics

Table 41: Schematic overview of the RPO topics. The table shows which recommendations should be considered discipline specific and which can be generalized. The importance based on the heat maps from WP5 is listed for the four disciplines.

Topics/subtopics	Approach to the recommendations	Importance, based on the heat maps from WP5
Education and training in RI a. pre-doctorate b. post-doctorate c. training of RI personnel & teachers d. RI counselling and advice	<u>General approach</u> <ul style="list-style-type: none"> PhD students <i>and</i> supervisors should receive training. Use real life examples and cases in training <u>Discipline specific</u> <ul style="list-style-type: none"> Different emphasis on topics to be covered in training is needed. Tailored approach to meet the needs of the different disciplines when developing guidelines on training. 	Humanities: important Social science: important Natural science: very important Medical science: very important
Responsible supervision and mentoring a. PhD guidelines b. supervision requirements & guidelines c. building and leading an effective team	<u>General approach</u> <ul style="list-style-type: none"> Limiting the amount of PhD students, a supervisor can have Having more than one supervisor <u>Discipline specific</u> <ul style="list-style-type: none"> Different topics are considered of different importance for the four disciplines, and those topics should be covered more elaborately for that specific discipline. 	Humanities: important Social Science: very important Natural sciences: important Medical sciences: very important
Dealing with breaches of RI: a. RI bodies in the organization b. protection of whistleblowers c. protection of those accused of misconduct	<u>Comments</u> The legalistic nature of the topic implies a need for a uniform approach when developing guidelines and procedures. Disciplinary differences most likely play a smaller role	Humanities: important Social Science: very important Natural sciences: very important Medical sciences: important

<p>d. procedures for investigating allegations</p> <p>e. sanctions</p> <p>f. other actions (including mobility issues)</p>	<p><u>General approach</u></p> <ul style="list-style-type: none"> • Provide clarity on procedures • Transparency of the timeline of a procedure • Transparency of what constitutes a breach <p><u>Discipline specific approach</u></p> <ul style="list-style-type: none"> • Discipline and field specific guidelines on what constitute a breach and honest errors • Guidelines should leave room for discipline specific structures and procedures to deal with research misconduct 	
<p>Research ethics structures</p> <p>a. set-up and tasks of ethics committees</p> <p>b. ethics review procedures</p>	<p><u>Comments</u></p> <p>The legalistic nature of the topic implies a need for a general approach to setting up guidelines, dividing tasks and having similar ethical procedures on a higher level.</p> <p><u>General approach</u></p> <ul style="list-style-type: none"> • Specification of function and legal status of Ethical Review Boards (ERBs). • Involving persons in ERBs with the appropriate knowledge to review the diverse range of proposals. • Improvement of the duration of ethical reviewing was considered important. <p><u>Discipline specific approach</u></p> <p>Call for guidelines to be mindful and flexible when disciplinary differences are taken into account when applying the guidelines.</p>	<p>Humanities: important</p> <p>Social Science: minimal importance</p> <p>Natural sciences: important</p> <p>Medical sciences: important</p>

Data practices and management a. guidance and support b. secure data storage infrastructure c. FAIR principles	<u>General approach</u> <ul style="list-style-type: none"> Support on compliance to the GDPR is needed. Ad-hoc support for data management. <u>Disciplinary specific approach</u> The type of support given should be tailored to meet the needs of the four disciplines. <ul style="list-style-type: none"> Standardization Central repository 	Humanities: important Social Science: important Natural sciences: important Medical sciences: very important
Declaration of competing interests a. in peer review b. in the conduct of research c. in appointments and promotions d. in research evaluations e. in consultancy	<u>Comments</u> No specific recommendations were provided by the four disciplines.	Humanities: important Social Science: important Natural sciences: somewhat important Medical sciences: minimal importance
Research environment 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 g. supporting a responsible research process (transparency, quality assurance, requirements)	<u>General approach</u> <ul style="list-style-type: none"> Subtopic a: Incorporate value of teaching, non-research activities and quality of research Subtopic c: change culture of short-term contracts Subtopic g: finding a balance in regulating the research process and valuing quality over quantity <u>Discipline specific</u> <ul style="list-style-type: none"> Subtopic b: implement periodical session to discuss progress and encountered difficulties, especially stressed by the natural and medical sciences 	Humanities: very important Social Science: very important Natural sciences: very important Medical sciences: very important

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	<u>General comments</u> <ul style="list-style-type: none"> • Create awareness of existing guidelines • Subtopic c: use and oblige repositories • RPOs need to support the financial side of open access publishing 	Humanities: important Social Science: important Natural sciences: important Medical sciences: somewhat important
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	<u>Comments</u> The natural and medical sciences are likely more often involved in such collaborations, and therefore have more and specific ideas on this topic. <u>General comments</u> <ul style="list-style-type: none"> • Subtopic b: Standardization of data management in collaborations • Subtopic a: Share contractual obligations • Keep record in registries of public-private collaborations • Have good practice guidelines or agreements on team size <u>Discipline specific</u> <ul style="list-style-type: none"> • Subtopic a for the medical sciences: have clarity and swift procedures on medical ethical approval 	Humanities: minimal importance Social Science: important Natural sciences: important Medical sciences: somewhat important

3.3.3 Schematic overview of RFO topics

Table 42: Schematic overview of the RPO topics. The table shows which recommendations should be considered discipline specific and which can be generalized. The importance based on the heat maps from WP5 is listed for the four disciplines.

Topic/subtopics	Approach to the recommendations	Importance
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	<u>Comments</u> Due to the legalistic nature of dealing with breaches of RI, with national and institutional guidelines, a general approach rather than discipline specific approach is preferable. <u>General approach</u> <ul style="list-style-type: none"> • Create a culture that leaves room for mistakes • Focus on prevention • Ensure the RPO has appropriate RM procedures in place • Have fair and simple procedures to protect whistleblowers and those accuse of RM • Specifying in the research grant how RM cases will be handled <u>Discipline specific</u> No discipline specific recommendations	Humanities: important Social Science: Very important Natural sciences: important Medical sciences: important
Declaration of competing interests a. among review committee members b. among reviewers c. among staff members	<u>General approach</u> <ul style="list-style-type: none"> • Bring in new reviewers/changing reviewers regularly • Not have reviewers from the organization submitting the proposal • Attract international reviewers <u>Discipline specific</u> No discipline specific recommendations	Humanities: minimal importance Social Science: important Natural sciences: very important Medical sciences: very important

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	<u>General approach</u> <ul style="list-style-type: none"> • Have the right Codes and Guidelines in place • Have policies in place to deal with breaches of RI • A generalized approach is applicable and no discipline specific elements are recommended <u>Discipline specific</u> No discipline specific recommendations	Humanities: important Social Science: important Natural sciences: Very important Medical sciences: somewhat important
Selection & evaluation of proposals a. RI plan b. methodological requirements c. plagiarism d. diversity issues	<u>General approach</u> <ul style="list-style-type: none"> • Include an RI plan that is approved • Make sure to give clear instructions to reviewers • Attract international reviewers <u>Discipline specific</u> The humanities may have slightly different selection criteria, as their research proposals are more diverse by nature/methodology.	Humanities: important Social Science: important Natural sciences: important Medical sciences: very important
Research ethics structures a. research ethics requirements b. ethics reporting requirements	<u>General approach</u> <ul style="list-style-type: none"> • Use the right discipline-specific ethical guidelines • Funders can incentivize RE <u>Discipline specific</u> No discipline specific recommendations, but it should be taken into account that disciplines need different approaches	Humanities: very important Social Science: very important Natural sciences: important Medical sciences: very important
Collaboration within funded projects a. expectations on collaborative research	<u>General approach</u> <ul style="list-style-type: none"> • RFOs can control for sound management structures to foster good collaborations <u>Discipline specific</u>	Humanities: somewhat important Social Science: important Natural sciences: important

b. research that is co-financed by multiple funders	No discipline specific recommendations	Medical sciences: somewhat important
Monitoring of funded applications a. financial monitoring b. monitoring of execution of research grant c. monitoring of compliance with RI requirements	<u>General approach</u> <ul style="list-style-type: none"> - Avoid meaningless checkboxes - Divide tasks between RPO and RFO related to monitoring <u>Discipline specific</u> It may be that in the natural sciences, things should be already planned while in the social sciences changes/deviations are more acceptable	Humanities: important Social Science: important Natural sciences: important Medical sciences: somewhat important
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	<u>General approach</u> <ul style="list-style-type: none"> • Having a good grant agreement before the start of research • Assure academic freedom <u>Discipline specific</u> No discipline specific recommendations, however medical and natural sciences work more often with industry and thus need slightly different approaches	Humanities: very important Social Science: important Natural sciences: important Medical sciences: very important
Publication and communication a. publication requirements b. expectations on authorship c. open science (open access, open data, transparency)	<u>General approach</u> <ul style="list-style-type: none"> • Get rid of gift authorships with strict rules • Reward/incentivize transparency in research (Open science) <u>Discipline specific</u> Authorship practices differ between disciplines and should be taken into account	Humanities: very important Social Science: very important Natural sciences: somewhat important Medical sciences: very important
Intellectual property issues None	<u>General approach</u> <ul style="list-style-type: none"> • RFOs should not get too involved. RPOs can handle this. <u>Discipline specific</u> No discipline specific recommendations	Humanities: somewhat important Social Science: somewhat important Natural sciences: important

		Medical sciences: important
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Drawing conclusions in order to determine what topics are most important per discipline.

Interestingly, the most important topics overall, as displayed in the heat maps for RPOs were supervision/mentoring, and research environment. Furthermore, most researchers considered declaration of interests and collaborative researcher among RPOs as slightly less important.

If you look at disciplinary differences, something that stands out is that for research ethics structures, the social sciences consider this minimally important, while the other disciplines find this important.

Declaration of competing interests is considered important for social sciences and humanities, while in the medical sciences, that is minimally important.

Finally, collaborative research among RPOs is considered (somewhat) important for most disciplines, except for the humanities; they consider this of minimal importance.

For the RFOs, the most important topics overall, as displayed in the heat maps for RFOs were all of them except for collaboration within funded projects and intellectual property. They were somewhat important.

If you look at disciplinary differences, something that stands out is that for funders expectations were very important for the humanities and somewhat important for medical sciences.

Declaration of competing interests is considered very important for natural sciences and medical sciences, while in the humanities, this was considered somewhat important.

Finally, for the topic communication and publication, this was considered very important for all disciplines, except for the natural sciences. They consider it as somewhat important.

3.3.4 Highlights and conclusions of the main disciplinary differences per topic/subtopic for RPOs and RFOs

Below we describe the conclusions we drew from the focus groups. We base our findings on the implications as written down in section 3.2 of this report. Please note the implications of all topics are assembled here, and no new information is added. However, we do propose that these conclusions will be added to the toolbox when we discuss the potential disciplinary differences. In addition, we suggest to take the recommendations of table 41 and 42 (see section 3.3) in the table into account when further crafting the toolbox. Table 41 and 42 provide a schematic overview of the importance of each of the topics for the different disciplines, in addition to summarizing the most

important overarching findings from the focus groups – by providing which recommendations need generalized approaches and which need to be tailored to meet the needs of the four disciplines.

For RPOs:

Education and training:

The topic education and training in RI raised more similarities than differences across the four disciplines. Important parallels between the disciplines are whom should receive training; PhD students *and* supervisors, the obligatory nature of the training and the use of real-life examples or cases. The main divergence can be found in which topics should be covered in the training, and what approach a training program should take. Nonetheless, this can be translated into the concrete recommendation of tailoring training to meet the needs of the four disciplines. Slight disciplinary differences may be present, such as differing emphasis on specific training topics, form or content. This will not have considerable implications for the toolbox but one can imagine that training in the humanities may be focusing more on plagiarism and building a culture of RI, in the social sciences more emphasis on open science and data management + dealing with and knowing the grey areas of research misbehaviour. The natural sciences put more emphasis on laboratory work, data management. This is also more important in the medical sciences where they put more emphasis on rules and regulations and have more need for training in ethics issues, data management and confidentiality.

Responsible supervision and mentoring

The four disciplines had slight diverging views on the subtopic PhD guidelines, while the subtopic supervision requirements and guidelines provided more similarities. Specifically, how PhD guidelines should be set up differs among the disciplines. For the social sciences and humanities, a concrete difference is providing guidelines for publication and (co)-authorship. For the natural sciences national guidelines are key, with the medical sciences stating yearly progress reports are necessary. These recommendations are not mutually exclusive and to fill the gap for most disciplines. Slight differences may be focusing on guidelines for supervision that are currently absent in most instances. The subtopic supervision and mentoring yielded many similarities, importantly, limiting the amount of PhD students a supervisor can have and having more than one supervisor are recommendations from the various disciplines.

Dealing with breaches of RI

While the topic dealing with breaches of RI covered a range of recommendations, with differences between the disciplines, the topic is of a legalistic nature, with procedures for dealing with

misconduct serving as guidance on an institutional level and/or national level. Hence, disciplinary differences most likely play a smaller role in preparing SOPs/guidelines for this topic, and the given recommendations given by all disciplines serve to guide the preparation of the toolbox. This means that most recommendations that came out of the focus groups can be extracted and extrapolated to all disciplines with most focus on the legalistic nature and the fact that clarity on procedures, transparency of the timeline of a procedure and breaches is essential for all disciplines. Nonetheless, the humanities and the social sciences highlighted the importance of demarcating what constitutes research misconduct. Not only a breach of RI in the humanities can be different than within the natural or medical sciences, there are slight differences between disciplines what constitutes research misconduct and what is considered an honest error. Moreover, procedures for dealing with breaches should be field-specific. These recommendations can be considered and imply a need for the toolbox to leave room for discipline specific structures and procedures.

Research ethics structures

Similarly, to the topic of Dealing with Breaches of RI, the topic of research ethics structures suggests some general needs across disciplines as well as discipline specific approaches for the toolbox. While for the humanities there were fewer specific recommendations, most likely due to the fact that some research domains in the humanities may face less ethical issues than others. The other three disciplines require a distinct approach. Importantly, the social sciences stresses that the function and legal status of the ERB should be clarified. In the natural and medical sciences this seems to be slightly less importance, most likely because the function of the ERB's is already more embedded within the institutional structure. Regarding the procedures, the medical sciences' recommendation includes that the procedures should become quicker, and contain checklists on what to send and create resources that researchers can contact the ERB fast with ad-hoc doubts or concerns. The social sciences require diversity in the ERBs to ensure the relevant knowledge is available to assess the range and diversity of research projects in the social sciences. All these recommendations are most likely also applicable to the other domains and we would be reluctant to make clear distinctions between disciplines here. The best approach would be to call for guidelines that should be mindful and flexible when disciplinary differences are considered when applying guidelines.

Data management

With different issues discussed in relation to data management, and various recommendations were given, there are various implications for the toolbox. The type of support given differs slightly among the disciplines, however, access to and the provision of tailored support on data management is stressed in the humanities, natural, and medical sciences. In addition, support on compliance to the GDPR needs to be incorporated, mostly discussed in the social sciences groups but applicable for all disciplines. For both the humanities and natural sciences, ad-hoc support should be available and set

up and this will be applicable to the other disciplines as well. The social sciences stressed standardization, where the medical sciences recommend the establishment of a central repository. Hence, the subtopic secure data storage and infrastructure should be implemented in a discipline specific way in the toolbox.

Declaration of competing interests

Since no specific recommendations were given by the different disciplines, the topic competing interests does not have any implications for the toolbox. There are slight alterations that are worth mentioning: or the humanities Col are localized mostly in peer review, and how appointments and promotions are given. In the social, natural and medical sciences, also evaluation and appointment procedures are sensitive for Col, specifically with commercial collaborations. The participants also briefly highlighted the big national differences on awareness and adjustments of Col.

Research environment

For the topic research environment, the disciplinary differences have various implications for the toolbox. For the subtopic fair procedures for appointments and promotions, the toolbox should incorporate the value of teaching, non-research activities and quality of research for all disciplines. They all recommend that clear and transparent promotion criteria are essential for a healthy research environment. For the second subtopic, education and skills training, the recommendation from the natural and medical sciences both included having periodical sessions to discuss progress, which should be implemented *discipline-specific in the toolbox*. For the subtopic culture building, the humanities recommendations of changing the culture of short-term contracts can be implemented, with the social sciences wanting to improve transparency of evaluation and promotion criteria. These recommendations are most likely also applicable to the other disciplines. For the subtopics conflict management and publication pressure only one of the disciplines provided recommendations, which can be taken up by the toolbox (see table 43/44). For the last subtopic, supporting a responsible research process, the social sciences have the specific recommendation of finding a balance in regulating the research process but most likely is applicable to all disciplines. This should be taken into consideration when developing the toolbox. The natural sciences' focus lay with the evaluation of research, with quality trumping quantity. This should also be considered for all disciplines.

Publication and communication

The most important implications for the toolbox related to Publication and communication concern the sub-topics authorship and open science. For the first subtopic the use and awareness of existing

guidelines should be taken up and be considered for all disciplines. For open science, the medical, social and natural sciences recommend creating repositories and making these obligatory. Although this may be less applicable/feasible for the humanities, this is also a recommendation for some fields in the humanities. For all disciplines (financial) support for open access publishing needs to be shared by the RPOs.

Collaboration among RPOs

For the first subtopic, collaborations among RPOs inside and outside the EU the medical and natural sciences need distinct approaches in the toolbox. The medical sciences' recommendations of having clarity on ethical approval needs to be implemented. For the natural sciences, the recommendation on team size can be incorporated. For the subtopic collaboration with countries with different R&D structures, the social sciences require standardization to data management in collaborations. The last subtopic, collaboration between public and private RPOs again requires a separate approach for the natural and medical sciences. The natural sciences recommendation implies contractual obligations need to be shared. The medical sciences, on the other hand, specifies private-public collaborations need to be kept in registries. Lastly, the natural and medical sciences are likely more often involved in such collaborations, and therefore have more and specific ideas on this topic. However, it is important that these recommendations and regulations are also put in place for the humanities and social sciences.

For RFOs:

Dealing with breaches of RI

The topic dealing with breaches of RI is of legalistic nature and closely connected to national legislation. The RFO can play a role in strengthening the structures, but the responsibility of dealing with breaches of RI lies with the RPOs and national legal systems. Furthermore, as was stressed when dealing with this topic for RPOs, the issues highlighted above in table above should be understood as different ideas and recommendations generated in the different main area of research's focus group discussions. However, most of them are generic ideas that can be implemented across disciplines to strengthen RI and deal with breaches of RI.

Many of the recommendations can be taken up in the toolbox. This is, for instance, the case with the social sciences' recommendations of creating a culture with room for mistakes and a focus on prevention. These two recommendations are important for all disciplines. Many other recommendations can also be taken up, such as ensuring legal procedures for dealing with RM are in place, having simple and fair procedures for protection whistleblowers and those accused of RM and specifying in the grant how RM cases will be handled.

Declaration of competing interests

The topic, declaration of competing interests, was discussed in various ways by all disciplines, where some disciplines mainly paid attention to conflicting interests among reviewers, and others conflicting interests among review committee members. Several suggestions for how RFOs can handle conflicting interests came up in the discussions, as highlighted above in table 23. Though the suggestions came up in specific main areas of research's discussions, all of them are generic ideas that can be implemented in all disciplines to handle competing interests.

Many of the recommendations can be taken up in the toolbox, such as changing reviewers as suggested in the humanities, and avoiding people from the same organization reviewing each other's work as suggested in the social sciences. Three main areas of research also suggested a focus on attracting international reviewers, but this should probably be considered for all disciplines. The recommendation of courses on funding ethics, as suggested in the humanities, is also an idea for the toolbox.

Funders expectations of RPOs

Interestingly the topic had quite similar recommendations across the disciplines. There are some recommendations that appeared in discussions in specific disciplines only, but we consider these recommendations also applicable to other disciplines (such as demanding seniors to partake in RI-training). The outcomes of this topic imply that a generalized approach can be taken in the toolbox for this topic.

Selection and evaluation of proposals

A huge variety of recommendations was put forward for the topic selection and evaluation of proposals and its subtopics across all main areas of research. Each main area of research came up with several recommendations in their individual discussions as highlighted in table X above. Still, all or most of them are generic ideas that probably can apply to other main areas of research, many of these recommendations can be taken up in the toolbox. However, there are some discipline specific recommendations; the humanities specific recommendations should be developed to meet the needs of the humanities in the toolbox.

Research ethics structures

The topic research ethics structures raised many useful recommendations. The funders can clearly play a role in incentivizing RE, and ensuring that appropriate structures are in place at the RPO level. For example, RPOs must have clear guidelines in place for *when* researchers need to apply for ethical

approval and for *how* they exactly do that. Here, disciplinary differences also have to be considered, especially for the humanities.

Collaboration within funded projects

This topic raised few recommendations, however, the common problem of following the highest standards in cross-boundary collaborations was discussed in three out of four disciplines. The medical sciences' recommendation that the highest standards should be followed in case of different standards could be taken up in the toolbox. The natural sciences stress the responsibility of the RPO regarding this topic, which can be taken up as a general recommendation.

Monitoring of funded applications

This topic has many generic recommendations. However, the recommendations of the social and natural sciences regarding the monitoring of the execution of the research grant are somewhat different, and (perhaps) require different approaches in the toolbox. It looks like that in the natural sciences, things should be already planned and there is less room for change while in the social sciences changes/deviations are more acceptable, although they have to be described well.

Updating RI-policy

The recommendation of checking regularly if policies are still appropriate could be turned into a guideline that covers all RFOs, no matter which disciplines they cover.

Independence

For this topic, the social and medical sciences have differing views on preventing unjustifiable interference by the funder. The social sciences specify this should be considered before the research, where the medical sciences states that only when something has gone wrong, this should be looked into by the RFO. However, having a good grant agreement before the start of the research is essential to satisfy the recommendations from both disciplines, therefore, we a generalized approach can be taken on this in the toolbox. Moreover, the other recommendations about academic freedom and the use of guidelines that ensure RI in collaborations with industry can be seen as more general, and can be taken up in the toolbox with a more generic approach.

Publication and communication

The topic provided many good ideas for the future work on the toolbox. Guidelines are, for example, needed for valuing positive and negative results. The focus groups also showed that authorship

requirements differ between disciplines, and that SOPs and guidelines therefore have to be differentiated to match the research practices of the different disciplines. Common for all disciplines is, however, that it should be clear beforehand what the authorship policies are. The recommendation from the natural sciences to get rid of gift authorships is also important, and funders can play a role in setting strict and discipline specific rules on authorship and contributions to research. The subtopic open access also requires a diverse approach for the differing disciplines, although the common ground is that it should be as transparent as possible. All disciplines will benefit from a distinct set of discipline tailored tools dealing with data management practices, sharing and opening data and open access. Furthermore, there seems to be a need for guidelines for open access practices.

Intellectual property issues

The recommendation from the natural sciences has to do with the division of work between RFOs and RPOs, which is something that future versions of the Toolbox needs to consider carefully.

4. Towards the first online toolbox for the topics for RPOs

Template for website presentation

Below you find the template that WP1, 2 and 4 developed to help selecting resources that can be used in the toolbox.

Template for Resources

1. Title to present the resource at the Toolbox (NOT necessarily the original title of the resource – up to 20 words)²

Example: A procedure to render a replication study as effective as possible.

2. Purpose/Aim of the resource (up to 50 words)

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)

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 favor 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’).

² Please try to be as descriptive as possible, i.e. the title to reflect the content of the resource.

4. Link of the resource (if available)

e.g. <https://www.nature.com/articles/d41586-020-02142-6>

5. Reference of the resource

e.g. 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?

RPO Topic: Research environment

Subtopic: Supporting a responsible research process (transparency, quality assurance, requirements)

TAGS

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?

- | | |
|--|--|
| <input type="radio"/> Pre-graduate students | <input type="radio"/> RPO senior management staff (Rectors, Deans) |
| <input type="radio"/> Post-graduate students | <input type="radio"/> Members of RPO research committees |
| <input type="radio"/> PhD candidates | <input type="radio"/> Ombudsmen |
| <input type="radio"/> Early career researchers | <input type="radio"/> Funders |
| <input type="radio"/> Senior researchers | <input type="radio"/> Technicians in RPOs |
| <input type="radio"/> Researchers in industry | <input type="radio"/> RFO employees |
| <input type="radio"/> Supervisors | <input type="radio"/> Editors |
| <input type="radio"/> Tenured faculty members | <input type="radio"/> Publishers |
| <input type="radio"/> Research administrators | <input type="radio"/> Peer reviewers |
| <input type="radio"/> Members of Research Ethics Committees | <input type="radio"/> Policy makers |
| <input type="radio"/> Members of Research Integrity Offices/Bodies | <input type="radio"/> All stakeholders of scientific research |

4. Which organizational level does this resource serve best?

- ☐ System (macro level)



- Institution (meso level)
- Individual (micro level)

5. Who has produced it? (i.e. a project or an organization)

National Documentation Centre (Greece) and SPARC Europe as part of the work of the PASTEUR4OA project.

6. What is the applicability of the resource?

- Can be applied to a specific organizational or national context
- Has general applicability

7. When was it published/put into force?

- 2015

5. Next steps in WP4

In the next steps in WP4, we already have organised the Co-creation workshops. They will take place in October, November and December. This will lead to further development of the toolbox with the formation of skeleton guidelines for 6 underdeveloped topics. Furthermore, we take the first steps, together with WP1 and WP2 to form a first version of the online toolbox that will be online in October 2020. Below you will find the process of the formation of the sets of recommendations that are part of the work that will lead to the co-creation workshops.

5.1 Formulating the sets of recommendations

5.1.1 Background

The current version (V1) of the SOPs4RI toolbox consists of the merging of all outputs from WP3 (i.e. results of the Delphi, the scoping reviews and the expert interviews). To create the first version of the toolbox, we conducted a Delphi, did an interview study and conducted 2 reviews. Based on these results, we selected 9 topics for research performing organizations (RPOs) and 11 topics for research funding organizations (RFOs) to address in the toolbox. 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. 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 at all previously.

For this new version of the toolbox (V2), we have integrated the insights gained from the 30 focus groups from WP5 with the results of WP3 to further develop the toolbox and address the underdeveloped topics. The goal of this development phase is to create a draft of guidelines/SOPs per topic that contains a concrete set of recommendations (they will be part of the so-called SoRs) for each underdeveloped topic and subtopic. An overview of the underdeveloped topics can be found in table 43(for RPOs) and table 44 (for RFOs).

This goal serves two purposes: 1) create the next version of the SOPs4RI toolbox (V2), and 2) provide input for the Inspirations to be used in the co-creation workshops which are aimed at developing the third version of the toolbox (V3). The co-creation workshop Inspirations should contain stimuli that will help participants create guidelines on the topic at hand. Different types of stimuli (visual and textual) will be included in the Inspirations, including the earlier mentioned concrete SoRs from V2, ambiguous stimuli, as well as stimuli that are not relevant to the topic under discussion (for more information, see the co creation workshop protocol that will be available shortly). Using such a mixed set of Inspirations is necessary to allow participants to think and create freely when they try to identify what they think is important to address in a guideline for a topic, as well as to evoke participants' creativity and critical thinking during the co-creation workshops.

To downplay potential confusion about the SoRs, Inspirations and skeleton guidelines, we have written a description of these abbreviations to improve understanding of the terminology.

Set of Recommendation (SoR): This is a 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: This set serves as the main input of the Co-creation Workshops. It is created per subtopic and includes the Set of Recommendations, visuals and objects. Inspirations are necessary for the methodology of the co-creation workshops.

Skeleton Guidelines: This is the main output of the co-creation workshop. This is a first rough version of a guideline for a subtopic. The co-creation workshops will aim to have these guidelines as concrete and practical as possible on the one hand, and use the creativity from the co-creation workshops on the other hand to further explore the level of depth of these guidelines. They serve as the main input for the next version of the toolbox (V3).

5.1.2 Methodological steps for selection of topics/subtopics

The selection of which subtopics should be addressed is based on the outcome of the assessment of the existing documents and guidelines as found in the systematic scoping review, the focus groups and Delphi study. The assessment allowed for the identification of whether high quality guidelines/SOPs already exist and which knowledge gaps could be identified. The methodological step has been previously described in D4.2, however, we provide a brief overview of the process below.

In D4.2 the documents which were found in the systematic scoping review, and the documents gathered from the focus groups and Delphi study were initially assessed by JT, and a second assessor, IL performed the assessment at a later stage.

The documents were assessed on quality by rating the document from 1-5. Score/level 1: Not existing/no information or very scarce and not useful. Score/level 2: Some guidance on the topic, but of low quality. Score/level 3 (medium level): There is guidance and some information on the topic, but not very structured or complete. Score/level 4: The guidance is detailed and helps the reader through a specific topic, but information is not complete or sufficient and it is not always clear. Score/level 5: detailed and clear guidance on a specific topic. This 1-5 scale was used as a practical tool for us in our assessment of the content of the documents identified in WP3.

Next to the quality assessment, within each document it was assessed whether paragraphs or sections corresponded to a subtopic (as defined in the Delphi study) for RPOs and RFOs. After independent assessment of the documents the researchers discussed their findings and came to agreements on the quality assessment and correspondence of the subtopics. This qualitative step provided a preliminary overview of the quantity and quality of existing documents concerning all topics and subtopics. An initial rating allowed for categorizing all subtopics in three categories, and after discussion a fourth category was added (category 2). The categories are as follows: 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 available. The outcome of this ranking can be found in table 43 and 44. For a more elaborate overview of the methodological steps and the results of the assessment, please see D4.2.

This step is relevant as to which topics should be covered developing the SoRs and which topics should be covered in the co-creation workshops to provide input for the next step of developing the toolbox (V3) Next to the categorization of the differing subtopics, it was assessed whether these subtopics should be covered in the next methodological step to develop the SoRs (blue column of table 43 and 44). The criteria for including the subtopics to develop the SoRs can be found below.

For a description of the topics/subtopics, click [here](#).

Table 43: categorization of subtopics 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. In the last column, we highlight whether this subtopic will be handled by the teams in WP4 to develop SoRs.

Rank	Topic	Subtopics	Cat.1	Cat.2	Cat.3	Cat.4	Subtopics to address
1	Education and training in RI	a. pre-doctorate	X				Yes
		b. post-doctorate	X				Yes
		c. training of RI personnel & teachers				X	Yes
		d. RI counselling and advice				X	Yes
2	Responsible supervision and mentoring	a. PhD guidelines				X	Yes
		b. supervision requirements & guidelines			X		Yes
		c. building and leading an effective team			X		Yes
3	Dealing with breaches of RI	a. RI bodies in the organization	X				Yes
		b. protection of whistleblowers	X				
		c. protection of those accused of misconduct			X		

4		d. procedures for investigating allegations	X	
		e. sanctions	X	
		f. other actions (including mobility issues)	X	
5	Research ethics structures	a. set-up and tasks of ethics committees	X	
		b. ethics review procedures	X	
6	Data practices and management	a. guidance and support	X	
		b. secure data storage infrastructure	X	
		c. FAIR principles	X	
7	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
8	Research environment	a. fair procedures for appointments, promotions and numeration	X	
		b. adequate education and skills training	X	Yes
		c. culture building	X	Yes
		d. managing competition & publication pressure	X	Yes
		e. conflict management	X	
		f. diversity issues	X	Yes
		g. supporting a responsible research process (transparency, quality assurance, requirements)	X	
9	Publication and communication	a. publication statement	X	
		b. authorship	X	
		c. open science	X	Yes
		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	Yes
		b. with countries with different R&D infrastructures	X	
		c. between public and private RPOs	X	

Table 44: Categorization of subtopics 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. In the last column, we highlight whether this subtopic will be handled by the teams in WP4 to develop SoRs.

Rank	Topic	Subtopic	Cat.1	Cat.2	Cat.3	Cat.4	Subtopics to address
1	Dealing with breaches of RI	a. RI bodies in the organization	X				
		b. procedures for breaches by funded researchers			X		Yes
		c. by review committee members				X	Yes
		d. by reviewers				X	Yes
1	Dealing with breaches of RI	e. by staff members				X	Yes
		f. protection of whistleblowers and the accused		X			Yes
		g. sanctions/other actions		X			Yes
		h. communicating with the public	X				
2	Declaration of competing interests	a. among review committee members	X				
		b. among reviewers			X		Yes
		c. among staff members				X	Yes
3	Funders' expectations of RPOs	a. Codes of Conduct				X	Yes
		b. assessment of researchers				X	Yes
		c. education and training for RI				X	Yes
		d. processes for investigating allegations of research misconduct			X		Yes
4	Selection & evaluation of proposals	a. RI plan				X	Yes
		b. methodological requirements				X	Yes
		c. plagiarism				X	Yes
		d. diversity issues				X	Yes
5	Research ethics structures	a. research ethics requirements			X		Yes
		b. ethics reporting requirements				X	Yes

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

5.1.3 Selection of subtopics

The subtopics to be addressed in the third version of the toolbox will be selected based on the following inclusion criteria:

- The subtopic is underdeveloped (i.e. not covered by good quality existing resources, or not covered by any resources at all, see D4.2).
- Subtopics of higher ranked topics (*ranking concluded from Delphi study*) take precedence over lower ranked topics

The topics addressed in this stage can be found in the blue column of table 43 and 44.

Due to feasibility issues, we can only address 6 topics during the co-creation workshops. To identify which topics to address, we will use the following inclusion criteria:

- The topic is underdeveloped
- Higher ranked topics take precedence over lower ranked topics
- The topic is not legalistic - since legalistic topics are not appropriate for co-creation (e.g. dealing with breaches of RI)
- To understand how to address the topic, we need to learn about stakeholders' values - since these kinds of topics are appropriate for co-creation

5.1.4 Methodological steps for developing Sets of Recommendations (SoRs)

The next step was to develop the SoRs for the selected subtopics. Within WP4 small groups with 3-4 members were formed and allocated several subtopics in order to develop the first SoRs.

The tasks of the working groups were as follows:

1. Read the suitable WP3 documents that are related to the topic and subtopic assigned. All available documents will be provided, with a pre-selection of which documents correspond to which subtopics for both RPOs and RFOs. All these documents have been assessed by WP4 on quality, usefulness and feasibility. These documents form the reference for the discussions per team.
2. Summarize the major themes from these documents and discuss them in the group (per subtopic).
3. Identify gaps in the resources read.
4. Look for additional resources for the subtopic, which might fill the gaps identified.
5. Read the additional resources, summarize the major themes and discuss them in the group.
6. Formulate a set of recommendations for each subtopic. The recommendations should be as concrete and operational as possible, and should take into account the perspective of the policy maker.

7. Flag the remaining gaps/questions and summarize them per subtopic.

Working groups were encouraged to use an iterative process to formulate the SoRs. The teams could choose an initial approach of following the steps. After one week all team members reported their initial results and methodological steps taken to develop the SoRs. Strengths and weaknesses in the initial approaches were discussed, and strengths were taken up by the other teams to allow for closer alignment of the approaches. Per team the methodology is described below: (or in the appendix).

5.1.5 Current status of the first preliminary sets of recommendations

The sets of recommendations that are crafted by the teams are currently being developed. Although all teams have created SoRs for the subtopics that were selected, they will only be partially used in the co-creation workshops. We will not describe them in this deliverable, but will present them in the next deliverable (D4.4).

5.1.6 Refining recommendations

The next step is to implement the results of WP5 in the recommendations to account for disciplinary differences based on the results of the focus groups. In addition to providing content for the recommendations, the results will shed light on how to account for disciplinary differences for the topics/subtopics. Mads P. Sørensen (WP5 leader) will collaborate with each working group to discuss how to incorporate the results of WP5 into the set of recommendations created. This will include 1) determining how to ensure that the recommendations per topic/subtopic can account for disciplinary differences, 2) revising the set of recommendations per topic/subtopic, 2) adding additional recommendations where necessary.

5.1.7 Contributing towards the co-creation workshop with Inspirations

The co-creation team will work together with the WP4 working groups to adapt the set of recommendations for selected topics into the co-creation SoRs.

The co-creation team have had a first meeting with the involved WP4 members in June/July 2020 where the Inspirations of the co-creation workshops were prepared based on the recommendations for the selected topics. The Inspirations contain a mix of different Inspirations, both textual and visual, such as concrete recommendations from V2 of the toolbox, ambiguous stimuli, as well as stimuli that are not relevant to the topic under discussion. Additionally, a second meeting was held in early September to update the Inspirations based on the adjusted recommendations (taking into account results of WP5).

	Topic	Examples
<i>Prioritizing people and enhancing capabilities</i>	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
<i>Building research integrity into organizational structure</i>	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
<i>Ensuring clarity and transparency</i>	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 communication and	Guidelines for authorship; Procedures for open science and communication with the public

Figure 3. preliminary overview of 9 RI-topics for RPOs that correspond with the EcoC.

5.1.8 Towards the co-creation workshops

For 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), the sets of recommendations are used in the co-creation workshops. They lead to the formation of Inspirations. The inspirations are visual and textual representations of key elements of the sets of recommendations.

The other underdeveloped topics will also have sets of recommendations. In the next phases of the project, we will further refine these subtopics in the teams and make sure that they can be a starting point for further development of high quality guidelines



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