# D3.2: scoping reviews including multi-level model of research cultures and research conduct

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# SOPs4RI

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| | Andrea Reyes Elizondo, Wolfgang Kaltenbrunner (CWTS) |
| | Best practices for research integrity promotion in research performing and research funding organisations: a scoping review |
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# Contents

# 1. Introduction

## 1.1. About SOPs4RI

The Standard Operating Procedures for Research Integrity (SOPs4RI) project aims to contribute to the promotion of excellent research and robust research integrity culture aligned with the principles and norms of the European Code of Conduct for Research Integrity. The overall objective of the SOPs4RI is to create a toolbox to support and guide research performing organisations (RPOs) and research funding organisations (RFOs) in fostering research integrity (RI) and consequently preventing, detecting and handling research misconduct. The project focuses on providing Standard Operating Procedures (SOPs) and guidelines that will make it possible for RPOs and RFOs to create and implement Research Integrity Promotion Plans (RIPPs). SOPs4RI will thus stimulate transformational processes across European organisations involved in performing and funding research. SOPs4RI takes a mixed-method, co-creative approach to the development and empirical validation of SOPs and guidelines. The expected 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 development of SOPs and guidelines will take national, epistemic, and organisational differences into account, and the final toolbox will enable end-users to create Research Integrity Promotion Plans according to the needs of their organisation.

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

To develop a toolbox to support RPOs and RFOs in fostering RI and preventing, detecting and handling research misconduct, it is necessary to create an evidence base. This evidence base includes the factors that have a positive or negative influence on the implementation of RI in RPOs and RFOs, a model of the culture of research systems in different disciplines, and knowledge on existing practices for RI promotion. WP3 contributes to the aim of the SOPs4RI project with scoping reviews on the existing documents related to best practices

for RI promotion and factors influencing the implementation of the practices for RI promotion in RPOs and RFOs.

WP3 also includes interviews with RI experts and a Delphi survey study that will broaden the knowledge gathered through scoping reviews and develop it further for creating a first version of the SOPs and guidelines.

The following components are a part of WP3:

### 1) Literature review and modelling research cultures

As a starting point, a comprehensive literature search was conducted to explore all relevant knowledge that may contribute to the aim of the SOPs4RI. Two scoping reviews, regarding best practices for RI promotion in RPOs and RFOs and factors influencing the implementation of the practices for RI, were conducted.

In parallel to the literature review, the first task included the development of a framework to model research culture in different disciplines. The framework may contribute to better understanding of the impact of research culture on researchers and RI.

### 2) Expert interviews

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

### 3) Delphi survey study

Based on an iterative consensus process among experts in RI issues at RPOs and RFOs, a Delphi survey will identify the most important topics that will be covered by the toolbox.

## 1.3. About deliverable D3.2

Deliverable 3.2 provides reports on the following studies, all of which were part of WP3:

1) A multi-level model of research culture systems;

2) Scoping review on 'Factors influencing the implementation of practices for research integrity promotion in research performing organisations and research funding organisations';

3) Scoping review on 'Best practices for research integrity promotion in research performing and research funding organisations'.

# 2. A multi-level model of Research Culture

## 2.1. Coleman's boat

'Coleman's boat' (1), shown in **Figure 1** below, provides a framework to map the research system with its interactions between macro-level phenomena such as cultural values and institutional structures and micro-level phenomena such as individual behaviour. On the one hand, the choices and behaviour of individual researchers are influenced by the formal and informal governance arrangements of institutions in academia and the research funding system. And, on the other hand, the sum or aggregate of the choices and behaviour of individual researchers influences the development of strategic planning and the evolution of governance in academic and research institutions.
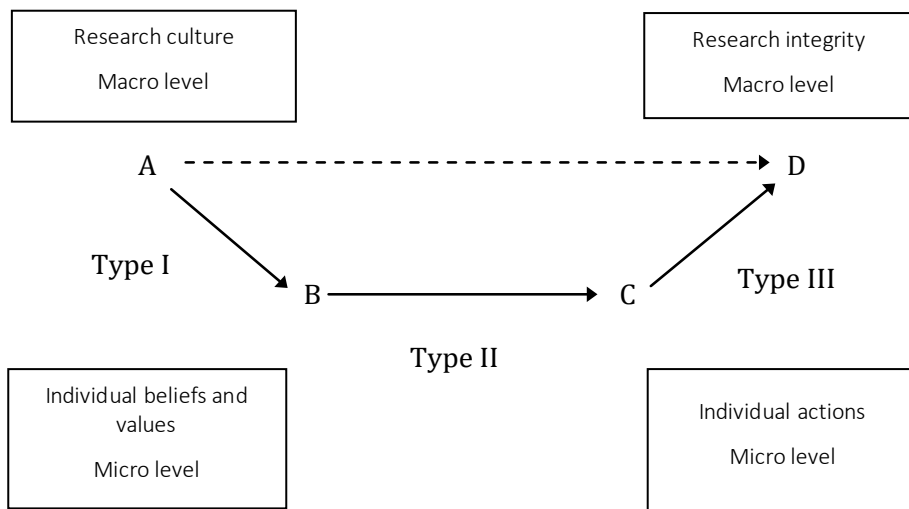


**Figure 1.** Research system: "Coleman's boat."

In **Figure 1** 'A' refers to the normative environment, the research culture; 'B' refers to the values and beliefs of researchers; 'C' refers to individual actions and research conduct; and 'D' refers to emergent outcomes, research integrity (RI) and quality evidence for

policymaking. Elements 'A' and 'D' are macro-level variables, whereas 'B' and 'C' are micro-level variables. Social mechanisms explain how 'A' leads to 'D'.

Type I (macro-micro) is a contextual mechanism that explains how macro-level conditions (e.g., culture or economic forces) affect the behaviour of individuals. Type II (micro) is an individual mechanism that evokes beliefs, attitudes, desires and opportunities as antecedents of action. It is called an action-formation mechanism. Type III (micro-macro) describes how individual actions generate collective outcomes – intended or not – and it is called transformational mechanism. Among the social sciences, the discipline most attuned to the study of transformational mechanisms is economics. In its simplest form, a transformational mechanism may refer to the direct extrapolation from the individual to the aggregate.

As an illustration of the impact of macro processes on the conduct of research and the quality of evidence consider the following example. Randomised control trials (RCTs) are widely accepted as tests of policy interventions designed to raise taxation, support the poor and improve education (2). Today, RCTs are demanded by some funders of development projects. One common assumption is that a finding from an RCT (often in an advanced country) will translate to other countries (often a developing country). The universalistic fallacy leads researchers to ignore institutional structures and social practices in the target country that may well have a strong bearing on the success of the intervention and on unintended side effects. Here we have a research culture (A) in which strongly held beliefs (almost paradigmatic) lead to researchers creating designs and interventions (B and C) that lead to challenges to integrity (D).

The import of a multi-level model in the understanding of the research system is to ensure greater RI and high-quality evidence for policy making (D), it is necessary not only to target researchers' actions at the micro level (C) but also to understand and potentially change the macro-level factors (A) that shape these individual beliefs and actions (B and C).

However, Coleman limits the analysis of social change to the macro and micro levels, the perspective of the methodological individualist. Hence, macro-level phenomena (in our case RI) can be fully explained by the interaction between institutional arrangements and the behaviour of individuals. This is inadequate as it fails to recognise that 'no man is an island'. Or to put it another way, while there may be lone scholars working in ivory towers,

many researchers work in formal groups or in informal networks. It is in these networks at the meso level that the day to day norms, procedures and practice of research are learned and experienced. The importance of the meso level is identified by de La Rua (3) who argues that at the meso level are networks of social relations that forge a person's identity. In the context of research, the meso-level is widely seen in research centres and groups, typically led by a person of some seniority. However, the meso-level can also include the organisations with their specific properties and local cultures.

## 2.2. UK higher education: A case study of multi-level modelling

### 2.2.1. At the macro level

Ball (4) argues that the reform of UK universities led to the introduction of business models and the pursuit of profit through a market place of educational service. He comments that "neoliberalism gets into our minds and our souls, into the ways in which we think about what we do, and into our social relations with others". The academic is re-invented as a mini-profit centre whose performance and productivity is audited to provide a rational basis for improvement. "Productivity is everything. Last year's efforts are a benchmark for improvement – more publications, more research grants".

Power (5) refers to the 'audit explosion', the use of financial auditing techniques in the assessment of non-financial processes with the aim of producing quantified 'key performance indicators'. Academic performance is measured in terms of research outputs and research impact (Research Excellence Framework) and teaching (Teaching Excellence Framework). The scores are aggregated to provide measures of departmental and research group performance and further aggregated to the university level. With such numerical performance indicators league tables of universities and departments can be constructed.

Academic publishing, a highly profitable enterprise, more or less invented journal 'impact factors' and 'citation counts'. Across the research system, these metrics have played an important role in the audit explosion. The top international journals compete for the best research but also for the most newsworthy and impactful research. To meet the demand for more and more publications, lower down the journal quality scale are some with a

relaxed attitude to quality and some new business models including 'pay to publish' with perhaps more emphasis on payment than on peer review.

## 2.2.2. Research funding bodies

Funding agencies have come under pressure to provide evidence of 'value for money' from the research they support. One evidential source is 'impact' which is now a substantial section in research grant applications. Proposers are invited to explain how the research will benefit society.

In the 'audit society' with the requirement for 'key performance indicators', a general statement regarding impacts is not sufficient.

## 2.2.3. At the meso level

The extent of collaborative research varies between disciplines. It is almost the norm in the life sciences and medicine, and relatively infrequent in the humanities. However, the context of most research is social in nature – in university departments, research groups or centres, and organisations. It is here that PhD students are supervised, where junior faculty develop their research programmes and begin their publishing career, and where seminars discuss the work of both internally and externally conducted research. Over recent years there has been an increase in generic training for PhD students on research practice, for example, ethics, philosophy of science and methodology.

However, the research culture goes beyond a few lectures. It is displayed in the 'role models' provided by the senior members of the group and how they interpret and operate within the institutional opportunities and constraints. It is also seen in their contribution to mentoring junior colleagues, in the provision of internal and constructive peer review, and in the implicit and explicit pressure across the group to turn research into publications.

## 2.2.4. At the micro level

'Publish or perish' captures the culture of contemporary academia. In times past academic tenure, more or less guaranteed a job for life. Of late whole departments have been closed due to insufficient student demand, senior staff with low research productivity moved into teaching only or administrative roles, and junior faculty appointed on short term contracts – the new academic precariat.

Plume (6), reports on a survey of 3090 published researchers of whom 81% agreed or strongly agreed with the statement: 'My career depends on a history of publishing research articles in peer-reviewed journals'. They cited the following reasons 1) 'At my institution, there are defined thresholds of publications for academic promotions at least during early career'; 2) 'Articles in peer-reviewed journals make the most important contribution to my career in terms of status, merit pay and marketability'; 3) 'If I publish well, I have more chance to get a better position and to obtain grants'; and 4) 'Because the primary role of my job is to produce research, which is of no use if it does not get into the public domain'.

In essence, the individual academic's recruitment, retention and promotion prospects are tied to publications. As the pressure grows, so does competition within the academic community.

## 2.3. The research system and challenges to research integrity

The preceding paragraphs characterise the contemporary research system in the UK. Some of these developments will resonate with the experience of researchers and academics in other European countries. It is not intended as a wholesale critique of structural changes over the last 25 years. Some would argue that the system of research funding and conduct was outdated and that changes were needed.

Returning to the multi-level model in **Figure 1**, it is possible to identify possible 'contextual mechanisms' linking macro processes to questionable research practices (QRPs) at the meso and micro levels.

## 2.4. Contextual mechanisms

### 2.4.1. Auditing research

Across most of the university sector, the National Research Excellence Framework (REF) has led to competition for league table positions. Higher positions in the league bring prestige, government funding for research and a more favourable context to support research grant applications. This applies to both universities as a whole and to individual departments and research centres. Many universities have REF committees regularly monitoring the performance of academic and research staff and devising strategies to

maximise the likelihood of REF success. The pressure to 'publish or perish' is felt by many individuals and under such pressure, some researchers may seek to publish without the normal due diligence or without replication of a surprising finding. With a promotion or, in extremis, a career at stake, QRPs as a means may be justified by the ends. As in business and sports competition in academia may stimulate greater productivity. But, as in business and sport, some academics may opt for illegitimate paths on the road to success.

## 2.4.2. The pursuit of impact

As with research excellence, research impact brings institutional and individual publicity, acclaim and prestige. The impact agenda starts with the guidance notes for research grant applications which demand quantified societal benefits. They stand as an encouragement for those with a fertile imagination to make extravagant claims without a warrant, or intention to deliver, in the knowledge that there are no penalties for a gap between impact aspiration and actuality. As the research progresses and reaches findings and conclusions, the pursuit of impact may encourage institutional public relations function and researchers themselves to rush into premature claims of impact on public policy etc. without a thorough check of analytic procedures or the neglect of a replication of what might be a surprising finding. There is almost a collusion between funding bodies, research institutions, academic journals and the media to impact hyperbole.

## 2.4.3. Peer review

Another consequence of pressure on researchers is the decline in the standards of the peer review. For the sociologist Robert Merton (7), one of the hallmarks of the scientific ethos was 'disinterestedness', exemplified in the accountability of scientists to their peers through the process of review by fellow experts. Merton was criticised for his idealised statement of the scientific ethos; today, the reality of the peer review process in many academic journals falls way short of Merton's normative position. Complaints about the peer review process are nothing new, but the volume appears to have increased. The concerns include doubts about the competence of reviewers; reviewers who offer little more than a positive or negative opinion without explanation; reviewers who take the opportunity to recommend citing their own work, and editors who can count but are not willing or able to exercise editorial judgement. These criticisms may be due, in part, to the fact that for the vast majority of journals, reviewing is pro bono. Researchers may feel that

they simply cannot set aside the time for a quality review. Behind the troubles of the peer review system, the elite journals compete for top quality research and research findings with 'news-value' which may on occasions trumps quality c.f. Wakefield's paper on MMR and childhood autism in the Lancet.

## 2.4.4. Meso level impacts on the micro level

Some junior researchers may have the good fortune to find themselves in a research culture in which high standards of integrity are set, where young researchers are mentored and supported, where contributions to the research are recognised in the authorship of publications, and where career development is a priority. In such setting, adherence to high standards of integrity and ethics are combined with a commitment to professional development.

Other young researchers may be less fortunate. They may find themselves in a meso-culture antithetical to the pursuit of integrity. They may experience harassment and exploitation and a climate of bullying and pressure. The culture may be highly competitive in which the ends (more publications) justify any means including cutting corners if it facilitates publications. In such setting, research group directors or institutional policymakers are likely to dismiss the concept of RI and reject the idea of training on the topic. For the junior researcher, there are perhaps three options in response to the research culture – Hirschman's loyalty, voice and exit. A culture of RI is likely to breed loyalty (8). But are voice or exit feasible options in a culture that lacks integrity? A critical voice is tantamount to a letter of resignation in an institution without a whistle-blowing charter, and exit could mean the end of a career in research.

## 2.4.5. Transformation mechanisms for micro to macro

In the multi-level model, the transformational mechanisms are the result of the intended or unintended aggregate of choices at individual researchers' level impacting on the institutional, meso level. Here both negative and a positive transformation are conceivable.

If researchers perceive that QRPs have become the norm, then in the competition for publications and promotions etc. those pursuing RI will be at a disadvantage. On the grounds of self-interest, following the herd in a downward quality spiral would result in more problematic research outcomes. The contribution of scientific evidence to public

policy would be called into question along with the rationale for funding academic research.

Against such a depressing scenario there is evidence of positive transformational mechanisms. Researchers have made significant commitments to challenging QRPs, demonstrated failures to replicate noteworthy findings and supported the development of procedures in research and publication to support RI. Of particular note, and public relevance, has been the focus on the conduct and reporting of clinical trials. It is also of note that the US Academies of Science, DG Research in the European Commission and other institutions at the macro level have coordinated committees of distinguished researchers and/or funded new research projects on RI.

## 2.5. In conclusion

Some of the institutional arrangements and incentives inherent in the research system are dysfunctional. Regulations at the macro-level (the policies of national governments and RFOs) influence decisions and local cultures at the meso level (research centres, RPOs, groups, departments, and RFOs) which create everyday practices among researchers (micro level) that may challenge RI. Change will not come by a focus solely on the individual researcher – the micro level. The explicit and implicit norms and incentives of the entire research system must be understood if interventions towards the goal of greater RI are to be achieved. One priority for investigation is to establish how, if at all, local research cultures at the meso-level differ across the major disciplinary areas and, where necessary, the implications for promoting change.

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# 3. Factors influencing the implementation of practices for research integrity promotion in research performing organisations and research funding organisations: a scoping review

## 3.1. Introduction

Research integrity (RI) represents the base for the advancement of knowledge and science (1). Although there is no universally accepted definition of RI, it generally refers to performing research at the highest level of professionalism and ethical standards (2). RI evolves continually, and both institutions and individual scientists are aware of the vital role that RI plays in science. Research performing institutions (RPO) have sought to foster and promote RI within their structure by putting in place guidelines that help researchers to perform their tasks with adherence to RI principles. To accomplish this, establishing formal policies is not enough. It is important that institutions know how to implement practices for RI promotion so that researchers are aware of and understand the RI principles and responsibly perform research.

Studies show that severe violations of RI, i.e. falsification, fabrication, and plagiarism, are rare (3); on the other hand, despite wide promotion of RI, less severe breaches – the so-called questionable or detrimental research practices, seem to be more prevalent (4). Different factors may have an impact on questionable research practices, and they may concern individual researchers, institutions, or research system and research culture. This can include personal traits like narcissism and lack of moral integrity (5) or institutional omission when it comes to providing training, education, and raising awareness among researchers.

While some degree of competition among researchers is beneficial for the advancement of science, it has also been shown that high levels of competition for employment and funding can increase likelihoods of certain forms of misconduct (6). Researchers are under pressure to cope with often-conflicting requirements that are imposed on them, and this can put their adherence to the RI principles under test.

All factors that can lead to research misconduct can also have an impact on the implementation of RI practices within institutions or science in general. To identify these factors, it is essential to consider the existing research system and research culture and take into account everyone involved in research, including researchers, supervisors, policymakers, RI professionals, funders, journal editors, and reviewers. Individual researcher's behaviour is affected by the institutional culture and funding system. Since the researchers and their host organisations hold responsibility for research results (7), research performing organisations (RPO) and research funding (RFO) organisations have an essential role in promoting RI.

This review focuses on the experiences of RPOs and RFOs in the implementation of standard operating procedures (SOPs), guidelines, and codes for the promotion of RI. It provides information about what contributes to the implementation of the RI practices, what the benefits are of these practices, and which factors may incentivise research misconduct.

## 3.2. Objectives

This review aims to examine factors influencing the implementation of best practices for RI promotion within RPOs and RFOs.

Specifically, the review questions are:

1) What are the factors influencing the implementation of practices for RI promotion in research performing organisations and research funding organisations?

2) In which way are RI policies related to other institutional and research policies?

3) How do integrity policies fit into research cultures?

## 3.3. Data sources

In this scoping review, scientific literature and other documents on factors related to researchers, research institutions or research culture elements were reviewed. The literature presents how these factors can influence the implementation of RI practices in RPOs and RFOs in different scientific disciplines.

## 3.4. Concept

The concept of this review are factors (e.g. individuals' behaviour, institutional rules, positive or negative elements in research culture) that can have an influence on the implementation of practices for the promotion of RI in RPOs and RFOs.

## 3.5. Context

This scoping review examines existing literature within all fields of science related to factors that may have a positive or negative impact on the implementation of RI practices. This includes individuals' behaviour or personality traits, institutional endeavours to foster RI, incentives and sanctions for researchers as well as research culture elements such as funding and publication opportunities.

## 3.6. Methods

This scoping review was conducted following the methodology and guidance for the conduct of scoping reviews published in the Joanna Briggs Institute (JBI) Review's Manual (8). The detailed process of identifying sources of evidence is presented in the *Selection of the documents (sources of evidence)* section*.

### 3.6.1. Protocol

The review was conducted using the methodology outlined in the protocol "Best practices for research integrity promotion in research performing and research funding organisations: a scoping review protocol" (D3.1: Protocol for the literature review, the expert interviews and the Delphi procedure). The protocol was registered at the Open Science Framework under the registration of the WP3 component (Systematic reviews of practices and research cultures) of the SOPs4RI project, on April 11, 2019. The protocol is available at https://osf.io/saj4u.

### 3.6.2. Eligibility criteria

The documentation collected in the search included both peer-reviewed publications and grey literature. The focus was on the elements of research culture that might have an impact on the implementation of practices for RI promotion.

The aim was to identify documents that refer to the implementation of RI practices at the micro, meso, or macro level. This included the elements that pertain to individuals, institutions and more extensive research environment/culture in the context of the implementation of RI practices.

The search strategy did not have geographical restrictions or restrictions regarding the scientific field. The search of bibliographical databases did not have language restrictions, whereas grey literature search was limited to documents in English due to the possibility of a large number of irrelevant documents being retrieved. The documentation search did not include materials dating before 1990, as these documents are obsolete in context of this scoping review and do not provide an insight into the current state of affairs.

## 3.6.3. Information sources

A systematic search of bibliographic databases was performed based on the search strategy developed in cooperation with the librarian (Ana Utrobicic) at the University of Split School of Medicine. The European Code of Conduct for Research Integrity[2], with its terms and definitions, was taken as a starting point for the development of the search strategy. The detailed search strategy is presented in **Appendix A** to this report. The search included four bibliographical databases:

1. Scopus
2. Web of Science (WoS)
3. Medline
4. PsycINFO.

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[2] Available at https://allea.org/publications/joint-publications/european-code-conduct-research-integrity/.

Grey literature sources were:

1. Open Grey [3]
2. CORDIS [4]
3. World Conferences on Research Integrity [5]
4. The National Academies of Sciences, Engineering, and Medicine [6].

## 3.6.4. Selection of the documents (sources of evidence)

In the PRISMA extension for Scoping Reviews Checklist, sources of evidence are defined as different types of documents eligible for a scoping review (9). In this scoping review, relevant documents were research articles identified through databases search and other informative material identified from different sources.

The screening of all documents retrieved by a conducted search of bibliographic databases was done by three reviewers (Rea Ščepanović, Andrea Reyes Elizondo, and Wolfgang Kaltenbrunner). The screening process was performed using the EndNote[TM] tool (Clarivate Analytics, Philadelphia, PA; USA), which avoided duplication and facilitated a more systematic approach.

After removing duplicates and articles dating before 1990, the screening of titles and abstracts was performed. The second step included the comparison of the results and discussion about which documents would enter the full-text analysis. There were no disagreements among the three assessors regarding documents that were included in the full-text analysis. Data extraction of the included documents was performed independently by two reviewers (Ivan Buljan and Rea Ščepanović). After data extraction from the included documents, the screening of the reference lists of the included documents was performed.

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[3] http://www.opengrey.eu/

[4] https://cordis.europa.eu/

[5] https://wcrif.org/

[6] https://www.nap.edu/catalog/21896/fostering-integrity-in-research

This was performed to identify additional documents that met the eligibility criteria and could be valuable sources of information for this scoping review.

The screening of documents obtained through the search of grey literature was performed as follows:

1. Open Grey

Documents were found using the terms "research ethics" and "research integrity". The obtained documents were screened by titles.

2. CORDIS

The search was performed using the term "research integrity" which identified relevant projects for further analysis.

3. WCRI

The search included the web pages of the World Conferences on Research Integrity (WCRI). The aim was to find conference material, i.e. official conference documents, abstracts from the lectures, and workshop material that meet the inclusion criteria.

4. The National Academies of Sciences, Engineering, and Medicine

We performed a search of the book "Fostering Integrity in Research" to identify materials related to the factors influencing the implementation of the practices for RI promotion.

### 3.6.5. Data extraction

Data extracted from the material obtained in the bibliographic databases search was mapped into the following categories:

- Author(s)
- Title
- Year
- Include (yes/no)
- Reason for exclusion
- DOI
- URL
- Reference type

- Journal
- Country
- Field of science (Humanities, Social sciences, Natural sciences (including engineering), Biomedical sciences, Research in general)
- Whether the document is more related to RPOs or RFOs or to both
- Factors related to the individual researcher
- Factors related to institutions
- Factors related to research culture
- Positive impacts of the factors
- Negative impacts of the factors
- Type of document (research article or information/report)
- Empirically grounded (yes/no)
- Project related (yes/no)
- Name of the project
- Topics identified in the document.

Documents obtained from grey literature search were mapped to the following categories:
- Name of the document
- Year
- Country
- Field of science (Humanities, Social sciences, Natural sciences, Biomedical sciences, Research in general)
- Whether the document is more related to RPOs or RFOs or to both
- Factors related to individual researchers
- Factors related to institutions
- Factors related to research culture
- Positive impacts of the factors
- Negative impacts of the factors
- Description of the document
- Link to the document.

The categorization of documents was performed by two team members (RS and IB). In cases of disagreement or question, the consensus was reached after consultations with the third team member (AM).
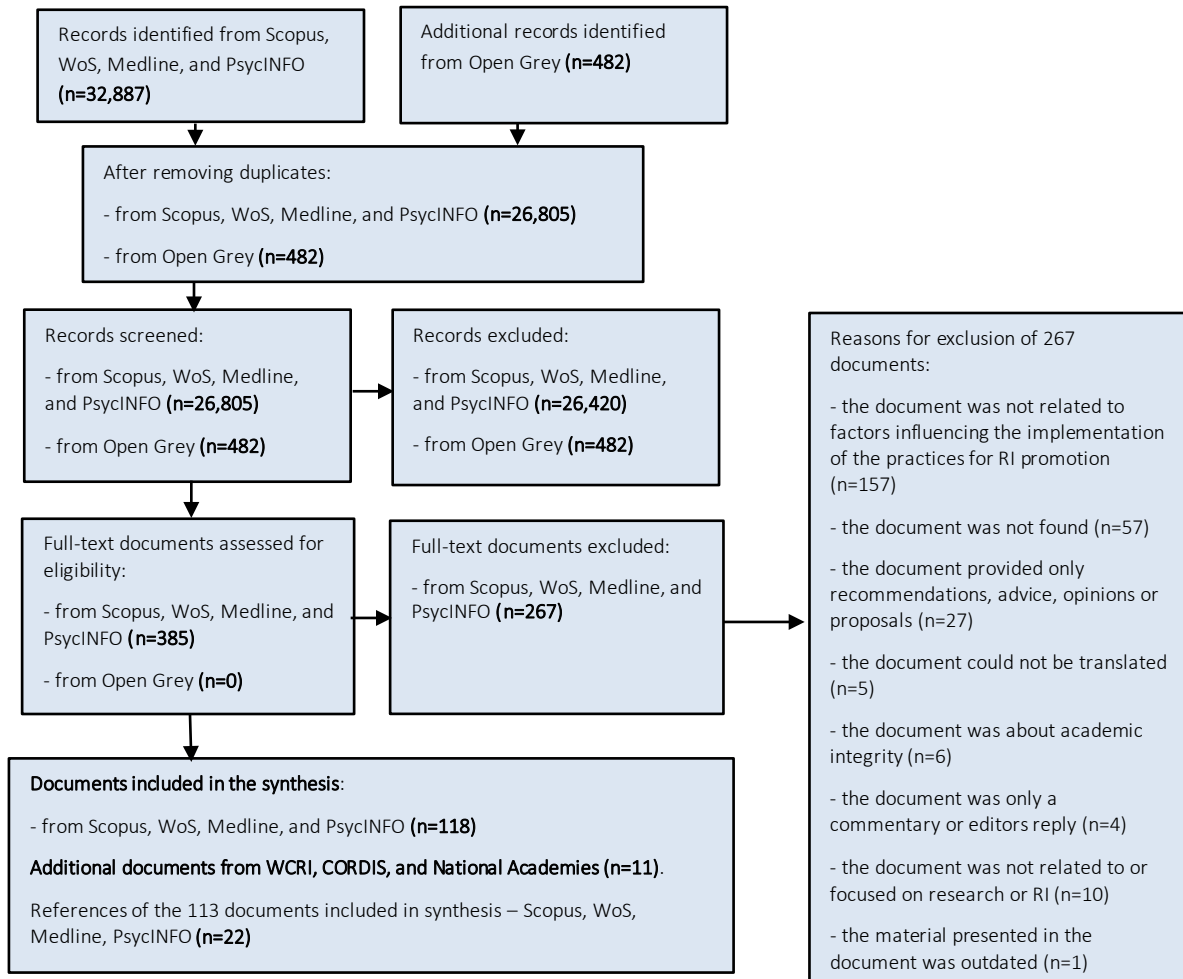
## 3.7. Results



**Figure 2.** PRISMA flow diagram for the scoping review process.

The search of Scopus, WoS, Medline, and PsycINFO retrieved 32,887 documents, with a total of 26,805 documents after removing duplicates. After screening of the titles and abstracts, 385 documents were selected for full-text assessment. In the step that followed, 267 documents were excluded, and 118 documents were selected for data extraction and analysis. The reasons for exclusion of the 267 documents are presented in **Figure 2**.

After final selection for data extraction, we screened the reference lists of the 118 included documents and identified 22 additional documents for the inclusion in the final data extraction and analysis.

The search of Open Grey database retrieved 482 documents. After screening of the titles, we did not identify any document that was related to factors influencing the implementation of the practices for RI promotion.

A search of the CORDIS database retrieved 5 documents, same as the search performed on the web pages of the World Conferences on Research Integrity. The search of CORDIS and the web pages of the WCRI was conducted to specifically search for the documents that meet the inclusion criteria. This means we did not export all documents contained in these sources, but rather that among accessible documents we searched those that were eligible for this scoping review and then exported them for the final analysis.

## 3.7.1. General characteristics of the obtained documents

The number of all documents that were included in the final analysis was 151; 135 of these documents were journal articles. Other types of documents included reports (n=4), book sections (n=3), project deliverables (n=3), conference proceedings (n=2), books (n=2), and presentations (n=2).

Among the documents identified from the bibliographic databases 36 were observational studies (all cross-sectional study design) and 5 were reviews. We did not identify any study with interventional study design.

From the aspect of the scientific fields, the documents were mapped into the following categories: *Humanities*, *Biomedical sciences*, *Natural sciences*, and *Social sciences*. If the document was not related to a specific field of science, but rather presented the material related to RI in all fields of science, it was mapped in the category *"Research in general"*. The number of the documents identified by the field of science is presented in **Table 1**.

Table 1. Number of identified documents by field of science

| FIELD OF SCIENCE | NO. OF DOCUMENTS |
|---|---|
| Biomedical sciences | 74 |
| Research in general | 69 |
| Natural sciences | 4 |
| Social sciences | 3 |
| Humanities | 1 |

Regarding the relation of the documents to RPOs, RFOs or to both types of institution, the documents referring to RPOs were most prevalent (n=127).

22 documents were related to both RPOs and RFOs, whereas only 2 documents were specifically related to RFOs.

## 3.7.2. Factors influencing the implementation of the practices for RI promotion identified in documents

The factors influencing the implementation of RI practices addressed in the documents were analysed based on the factors relation to the individual researcher, the institutions, or research system. We divided the factors into three categories, individual (micro), institutional (meso), and research system (macro), respectively. Some documents addressed factors from more than one of these categories. The factors addressed in the documents are presented in **Table 2**.

Table 2. List of factors addressed in the documents included in the analysis

| INDIVIDUAL FACTORS | |
|---|---|
| POSITIVE IMPACT | NEGATIVE IMPACT |
| <ul><li>High moral integrity (adherence to honesty and trustworthiness) (10)</li><li>Awareness of the importance of RI and its effect on science (11-13)</li><li>Awareness of existing policies regulating RI, willingness to participate in the RI training (11, 14, 15)</li><li>Disclosure of conflicts of interest (16,17)</li><li>Open communication and transparency between supervisor/mentor and student (18, 19)</li><li>Ethical behaviour of supervisor/mentor and senior researchers (11, 20)</li><li>Willingness to report the witnessed case of misconduct (21)</li></ul> | <ul><li>Pressure (to obtain funding, to publish, to increase productivity, to achieve positive results, to present groundbreaking research) (1, 19, 22-27)</li><li>Personality traits (negligence, lack of moral integrity, competitiveness, egoism, impatience, recklessness, laziness, ignorance, sloppiness) (1, 26, 28, 29)</li><li>Conflicts of interest (financial, professional, personal) (22, 30, 31)</li><li>Situational factors (e.g. financial issues of an individual) (26)</li><li>Relationship supervisor/mentor/senior researcher – student/junior researcher (lack of communication, unethical behaviour of mentor) (19, 23, 24, 28, 32, 33)</li><li>Career advancement (pressure to obtain tenure and salary) (25, 30, 33)</li></ul> |

| | |
|---|---|
| | • Lack of awareness of guidelines, lack of skills, and knowledge (24, 25, 34-36)<br>• Different perceptions of existing regulations and research misconduct (34, 37)<br>• Understanding of RI procedures as an administrative burden (38, 39)<br>• Fear of reporting misconduct (21, 40-43)<br>• Bias toward negative results (the "file drawer effect") (6)<br>• Cutting corners because of lack of time and heavy workload (44)<br>• Cultural differences (researchers may not be aware that something is not allowed since in their county it is) (24, 34, 45, 46) |
| **INSTITUTIONAL FACTORS** | |
| **POSITIVE IMPACT** | **NEGATIVE IMPACT** |
| • Collaboration with industry (provides funds) (47)<br>• Having efficient procedures for handling cases of misconduct as well as sanctions for offenders (18, 48-50)<br>• Good ethical climate (51, 52)<br>• Having RI officers or committees for handling claims of misconduct (37, 43)<br>• Conducting regular training on RI, research ethics or responsible conduct of research (14, 53-56)<br>• Providing training for mentors and supervisors (57) | • Collaboration with industry (possible conflicts of interest) (16, 17, 22, 30, 31, 47, 58-65)<br>• Lack of institutional policies for RI promotion and preventing misconduct; lack of policies for research ethics committees' procedures and sanctions for offenders (11, 22, 23, 28, 29, 33, 66-71)<br>• Lack of communication among different institutional bodies and employees (19, 23, 72)<br>• The bureaucracy of the research ethics committee procedures (38, 39, 73, 74) |

| | |
|---|---|
| • Open communication and transparency between supervisor/mentor and student (in the research group) (18, 19)<br>• Ethical behaviour of supervisor/mentor and senior researchers (in the research group) (11) | • Lack of training on RI, research ethics, or responsible conduct of research (23, 29, 33, 34, 41, 45, 70, 75)<br>• Diversity of guidelines among different institutions (1, 19, 58, 73)<br>• Rewarding a higher number of publications and higher impact (24, 44, 46)<br>• Lack of research monitoring practices (27)<br>• Short term contracts (76)<br>• Corruption (33, 77)<br>• Bad ethical climate (23, 52, 72, 78)<br>• Competitive atmosphere and stress within research group or organisation (1, 33, 40, 79) |
| RESEARCH SYSTEM FACTORS | |
| POSITIVE IMPACT | NEGATIVE IMPACT |
| • The role of publishers (publishing quality research instead only groundbreaking one; having procedures to react in cases of misconduct, retracting articles related to misconduct) (40, 44, 79, 80) | • Output (achievement) oriented funding system (32)<br>• Funding most visible research and with higher impact (80, 81)<br>• Challenges of implementing changes in the less developed societies (often because of the corruption) (80, 82)<br>• Lack of or insufficient system of quality control<br>• Role of citation metrics (journal impact factor, h-index) on the incentives provided to researchers if they publish in journals with higher impact (22, 44, 46, 80-83)<br>• Valuing quantity over quality (44)<br>• "Salami science" (25) |

| | • "Publish or perish" (6, 18, 23, 25-27, 79, 81, 84-89) |
| | • Differences in guidelines among different countries (19, 46, 85) Differences in perception of research misconduct among different countries (24, 26, 34, 44, 46, 54, 90) |

Numbers in brackets are references to individual documents.

## 3.7.3. Examples of individual, institutional, and research system factors

### 3.7.3.1. Individual factors

For the category of individual factors, we identified 126 documents addressing the factors with positive or negative impacts on the implementation of practices for RI promotion among individual researchers.

As factors with a positive impact on the individual level, the identified documents addressed moral integrity that is related to conducting research with honesty, fairness and truthfulness (10). Besides personal values, researchers' awareness of the importance of RI for their research, science, and society in general is also addressed as a factor that can influence the implementation of the practices for RI promotion (11-13).

The researchers' awareness and knowledge of RI can be enhanced by training in RI, RCR or RE. Training can help researchers to address RI issues within their research and to adhere to the responsible research practices in their future work (11, 14). Open communication of peers and good relationship between a supervisor and a student are also factors that can contribute to the promotion of RI (18, 10, 19). Mentors and supervisors play a big role in research conducted by PhD students (20). They are responsible for educating students in RI, which in most cases depends on the willingness of each supervisor/mentor but it also depends on the amount of work of every individual and the pressure from academic community requirements (23, 44).

Factors with a negative impact on the implementation of practices for RI promotion on the level of an individual researcher addressed personality traits such as narcissism, ego, and

greed, as well as overall lack of honesty and truthfulness in ones' actions, i.e. lack of moral integrity (26, 29, 91).

Researchers' behaviour may also be influenced by the external factors such as pressure to have continuous funding for the research and pressure to publish continuously (1, 19, 22-27). As the number of published articles is important for a researcher' career advancement, the pressure put on researchers to secure the salary or obtain tenure may incentivise them to get involved in research misconduct (25, 30, 33).

### 3.7.3.2. Institutional factors

Institutional factors were identified in 125 documents and were mostly related to conflicts of interest, as well as the pros and cons of RPOs' collaboration with the industry. Although collaboration with industry and financial incentives have an important role in scientific progress, they are often the source of conflict of interest (16, 17, 22, 30, 31, 47, 58-65).

Moreover, institutional endeavour to prevent cases of research misconduct by having an efficient system of sanctions, as well as establishing the RI offices or committees, may also be a factor that can contribute to the promotion of RI among researchers (18, 38, 48-50). Institutions are responsible for creating the culture of responsible conduct of research (23); therefore, they have the responsibility for developing policies and procedures for RI as well as implementing training for researchers (14, 53-57).

Institutional factors that contributed to the research misconduct and had a negative impact on the implementation of the practices for RI promotion the review were the lack of adequate monitoring of researchers' adherence to RI practices and obligation to handle cases of research misconduct in an appropriate manner (11, 22, 23, 27). Organisational ethical climate was also identified as a factor that can have a positive or negative impact on the practices for RI promotion. The ethical climate in organisations relates to moral, atmosphere, and ethics in the institutional environment, which is reflected, for example, in the care for the employees or way in which conflicts and disputes are solved (92, 51, 52).

Institutional factors related to the RFOs were mostly related to the endeavours to implement policies on RI that serve as guidance for RPOs and individual researchers in the process of obtaining funds (16, 17, 58, 81).

### 3.7.3.3. Research system factors

Research system-related factors were identified in 62 documents. In the process of addressing the factors as research system-related, we searched for the elements associated with values, norms, and common research practice in the global scientific community. These are elements that inevitably have an impact on the moulding of research culture at the institutions and among researchers. Research culture elements are not set at just one specific level. They are the constituent part of both individual and institutional levels, as well as the research system in general. Identified research system factors include the pressure that is put on the researchers if they want to survive in the competitive and rapidly developing academic environment (6, 18, 23, 25-27, 79, 81, 84-89). This is further connected to the overall quality assurance system in which researchers with a higher number of publications as well as publications in journals with higher impact factors have better chances of obtaining financial support from funders, and progress successfully in their academic career (22, 44, 46, 80, 81, 83).

The research system factors were further related to the global disparity regarding the uniformity of existing RI practices. The heterogeneity of existing RI guidance is present between different countries as well as between institutions (19, 46, 84). Besides the differences in written policies, there is also a lack of consensus among countries on what is considered as research misconduct (34, 24, 26, 44-46, 54, 93). This means that researchers from one country may not value something as research misconduct because in their research culture it is not defined as one, while in other research communities the same case is treated as misconduct. This can especially become a problem for research mobility, when researchers move to institutions in different parts of the world where different rules are in place and when sufficient measures for education and integrating the researcher into the new community are not available (94). Another important factor identified at the research system level is the funding mechanism for the universities, including research. By implementing output oriented research policies, the emphasis regarding what research will obtain funds is predominantly on the amount of the research publications, and the overall amount of funds received for research from different sources (95).

Most of the factors with a positive impact on the research system level were related to the initiatives of editors, publishers, peer reviewers, and funders. Peer reviewers and editors have an important role in raising awareness about RI issues in the scientific community.
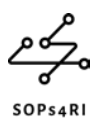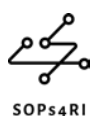
They have developed and implemented RI policies for reviewing submitted articles, declaring conflicts of interests, authorship and responsible publishing; they also take actions when misconduct is noticed by issuing correction or by retracting articles in order to preserve the integrity of the published record (96).

## 3.7.4. List of documents included in the analysis

The list of documents included in the final analysis is presented in **Table 3**. The list includes documents from databases Scopus, Medline, Web od Science, and PsycINFO and documents obtained from Open Grey, Cordis, WCRI, and National Academies of Sciences.

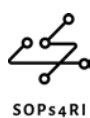**Table 3**. List of documents included in the analysis

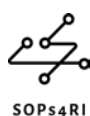| |
|---|
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| Abbas M, Pires D, Peters A, Morel CM, Hurst S, Holmes A, et al. Conflicts of interest in infection prevention and control research: no smoke without fire. A narrative review. Intensive Care Med. 2018;44:1679-90. |
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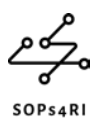
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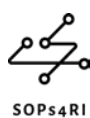
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## 3.8. Conclusion

In this scoping review, we summarised the existing knowledge on factors that may influence the implementation of RI practices within RPOs and RFOs. We categorised these factors based on their relevance for the researchers, organisations, and research system. They can also be perceived as factors that have an influence on three different levels of research – micro, meso, and macro.

We also explored the positive or negative impact of the factors on the implementation of practices for RI promotion within research organisations. Most of the factors identified in this review had negative impact on RI. The prevalence of factors with negative influences

indicates that researchers and the scientific community are engaged with issues that may have detrimental consequences on research and diminish trust in science. If we look at the positive factors, we can see that already a lot has been done. Organisations work on raising awareness among its researchers by implementing policies and providing training, while scientific journals emphasise the importance of authorship guidelines and take action to address the consequences of research misconduct for the published record. While we identified possible factors that can be a starting point for the improvement in this area, it is still left to answer the questions on the efficiency of conducted measures. As there were no interventional studies identified in this scoping review, the conclusions cannot be reached about effectiveness of the initiatives for the promotion of research integrity.

The increase in awareness is illustrated by the fact that we identified only 13 out of 146 articles from 1990 to 1999 concerning the factors influencing the implementation of the practices for RI promotion. Although the numbers show that RI has an important role in contemporary science, the cases of misconduct still happen. Because of their interrelatedness, it is important that initiatives are taken on all three levels – micro, meso, and macro. It is difficult to change the behaviour of individuals without creating an environment in which principles of responsible research will guide them. Research culture certainly needs changes, but this is a true challenge since the results of this review show that there are important differences between countries regarding perceptions and management of research misconduct and RI guidelines and procedures (1, 19). Moreover, the "publish and perish" problem is well known, as well as the consequences that arise from the pressure to publish, but we found a lack of documents relating to the initiatives that could possibly change this problem. Implementing practices for RI promotion, i.e. SOPs and guidelines in both RPOs and RFOs may stimulate a change and raise awareness among researchers. However, policymakers must ensure that implementation of the practices for RI promotion is followed by education and training of researchers. Moreover, policymakers must ensure that investigations of alleged cases of research misconduct will be conducted and that offenders will face sanctions for their wrongdoings. This can be achieved by establishing special bodies within institutions, e.g. research integrity officers or committees. These bodies can not only investigate cases of research misconduct but can also help researchers with advice on RI in performing research and thus prevent involvement in research misconduct.

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# 4. Best practices for research integrity promotion in research performing and research funding organisations: a scoping review

## 4.1. Introduction

Modern science and research emphasise the importance of research integrity (RI) as it represents the basis for the advancement of reliable and trustworthy knowledge and scientific endeavours (1). Taking into account different geographical location, research cultures and stakeholders involved in research, what is referred to as RI in some countries is also known as responsible conduct of research (RCR) in other countries (2). The diversity exists in the definition of research misconduct as well (3), and specific practices for the promotion of RI may also differ in their form and content (4). Because of this, it may be difficult for researchers to know which practices to adhere to, in some situations; this can subsequently lead to research misbehaviours.

Research performing (RPO) and research funding (RFO) organisations have an essential role in the promotion of RI. Together with researchers, these institutions are responsible for research, and they should contribute to better science by implementing policies for the promotion of RI (5). This can be done by implementing codes, guidelines or more specific standard operating procedures (SOPs) that guide researchers through the research process and their day-to-day work.

To be able to develop such step-by-step procedures, it is important to explore existing best practices for the promotion of RI. This means that it is important to explore the existing norms – prescriptive or aspirational – provided in the written documents that serve as guidance to researchers (3). This review gathers knowledge on the existing practices for the promotion of RI that can be implemented in RPOs and RFOs. Based on the knowledge gathered through this review, the SOPs4RI project will develop a toolbox of the SOPs for RI promotion that could be implemented across research institutions by Research Integrity Promotion Plans.

## 4.2. Aim

This review aimed to identify best practices that can be implemented in RPOs and RFOs to promote RI among different scientific fields and ensure high-quality science.

The research questions of this scoping review were:

1) Which practices and standardised approaches for promoting RI and avoiding research misconduct exist in **RPOs**?

2) Which practices and standardised approaches for promoting RI and avoiding research misconduct exist in **RFOs**?

## 4.3. Data sources

In this scoping review, the 'population' is documentation related to RI practices for RPOs and RFOs in different scientific fields. Mentioned practices include any professional rules related to RI (SOPs, guidelines, codes of conduct, charters or checklists) as well as procedures for handling research misconduct.

## 4.4. Concept

The concept of this review is that there are existing professional rules and practices with implications on RI promotion.

## 4.5. Context

This scoping review examines the existing documents related to practices for RI promotion, within different phases of the research process, various institutions involved in research and different scientific fields.

## 4.6. Methods

This scoping review was conducted following the methodology and guidance for the conduct of scoping reviews published in the Joanna Briggs Institute (JBI) Review's Manual

(6). The detailed process of identifying sources of evidence is presented in the *Selection of the documents (sources of evidence) section.*

## 4.6.1. Protocol

The review was conducted using the methodology outlined in the protocol "Best practices for research integrity promotion in research performing and research funding organisations: a scoping review protocol" (D3.1: Protocol for the literature review, the expert interviews and the Delphi procedure). The protocol was registered at the Open Science Framework under the registration of the WP3 component (Systematic reviews of practices and research cultures) of the SOPs4RI project, on April 11, 2019. The protocol is available at https://osf.io/saj4u.

## 4.6.2. Eligibility criteria

The documentation search was comprehensive, including both peer-reviewed publications and grey literature. As stated in the research protocol, documents that meet the required criteria were those explicitly related to the practices for RI promotion in RPOs and RFOs and in which a description of these practices was provided. Specifically, this included articles and other documents related to codes, guidelines, charters, checklists, SOPs and other practices that serve as a basis for the promotion of responsible research among individual researchers and institutions. These practices were included in the context of different research phases (research planning, research performing, and publishing and evaluation). The terminology used for describing the practices mentioned above was previously defined in the protocol from the deliverable D3.1.:

- *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, norms, 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 scientific evidence. They may include checklists.

- *Standard Operating Procedure (SOP): a detailed, written instruction, aimed to achieve uniform action step-by-step.*
  SOPs prescribe specific actions; they liberate users from decision-taking by ensuring that the procedure is followed. They may come in the shape of a 'decision-tree'/flowchart-diagram, similar to what is referred to as an algorithm in clinical contexts.

Moreover, documents related to principles of good or ethical research practices (as presented in the European Code of Conduct for Research Integrity[7]), as well as materials related to specific procedures (e. g. establishment of RI or research ethics (RE) and other committees), and the work of RI officers or other bodies in charge of handling the cases of research misconduct were included.

The search did not have geographical or language restrictions for the purpose of exploring RI practices in various countries and different settings and research cultures. Moreover, there were no limitations regarding scientific fields. To get an overarching view on these practices, it was important to include documents relating to Biomedical sciences, Natural sciences, Social sciences and Humanities. Since research misconduct emerged as an important problem in late 1980s and in 1990s (3), only the materials dating from 1990 onward were included in the screening process. The reason for this was based on the need for ensuring applicability and contemporaneity of identified material. Documents related to academic integrity were included if they reflected on research performance and professional or unprofessional behaviour pertaining to research.

## 4.6.3. Information sources

First, a systematic search of bibliographical databases based on the search strategy developed specifically for this question was performed. The search strategy was developed to aim at high sensitivity rather than specificity and included a broad approach to the field.

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[7] https://allea.org/publications/joint-publications/european-code-conduct-research-integrity/

The detailed search strategy is presented in **Appendix A.** Four bibliographical databases were included:

1. Scopus
2. Web of Science (WoS)
3. Medline
4. PsycINFO.

The following grey literature sources were searched:

1. Open Grey [8]

A search of Open Grey database was performed using terms "research ethics" and "research integrity".

2. World Conferences on Research Integrity [9]

The web pages of the World Conferences on Research Integrity were searched for identifying conference documents and other relevant sources, i.e. abstracts and materials from lectures and workshop.

3. CORDIS [10]

The grey literature search also included the CORDIS database to identify projects related to RI and materials developed by those projects.

4. ORI [11] and ENRIO [12]

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[8] http://www.opengrey.eu/

[9] https://wcrif.org/

[10] https://cordis.europa.eu/

[11] https://ori.hhs.gov/

[12] http://www.enrio.eu/

A search of the documents listed at the web pages of the Office of Research Integrity (US) - ORI and the European Network of Research Integrity Offices - ENRIO was performed as they were sources of various documents valuable for this research.

5.  The National Academies of Sciences, Engineering, and Medicine [13]

The National Academies of Sciences, Engineering, and Medicine book 'Fostering Integrity in Research' was searched.

6.  Science Europe [14]

Science Europe web pages were searched to identify documents developed by the Working Group on Research Integrity.

7.  European Commission - Mutual Learning Exercise (MLE) on Research Integrity [15]

MLE on Research integrity web pages were searched to identify novel documents related to RI.

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[13] https://www.nap.edu/catalog/21896/fostering-integrity-in-research

[14] https://www.scienceeurope.org/

[15] https://rio.jrc.ec.europa.eu/en/policy-support-facility/mle-research-integrity

## 4.6.4. Selection of documents (sources of evidence)

In this scoping review, relevant sources of evidence were research articles and other documents that were identified through databases and other sources, as stated above, and which met the set of eligibility criteria. Moreover, both commentaries and editorials were included as possible sources of evidence if they were related to the SOPs/guidelines in the field of RI. Special attention was paid to the practices related to new and emerging issues in RI, such as the General Data Protection Regulation (GDPR), data sharing and Open Science. Other sources of evidence besides codes, guidelines, checklists, flowcharts and SOPs, included declarations, statements, white papers, policies, reports, laws, infographic material and books.

The screening of all content obtained through the search of bibliographic databases (Scopus, WoS, Medline, and PsycINFO) was conducted by two reviewers (Krishma Labib and Rea Ščepanović) independently. Both reviewers screened the titles of all studies retrieved by the database search. This increased to the accuracy of the process, and ensured that all relevant information was included. The process was carried out using the EndNote[TM] tool (Clarivate Analytics, Philadelphia, PA, USA), which helped avoid duplications and enabled us to employ a more systematic approach. After removing duplicates and articles dating before 1990, the screening of titles and abstracts was performed. After the first screening, reviewers compared the results, and both had to agree on the materials to be included in the full-text analysis. In cases of disagreement, the final decision was brought after discussion with two other reviewers (Ivan Buljan and Ana Marušić). Full-text analysis was performed by Krishma Labib, Ivan Buljan, and Rea Ščepanović. Data extraction of the included studies was performed by two reviewers (Ivan Buljan and Rea Ščepanović). Further, reference lists of articles included in the final results were screened to identify additional studies that met the eligibility criteria.

The screening of documents obtained through the search of WCRI, Open Grey, CORDIS, ORI, ENRIO, National Academies, Science Europe, and Mutual Learning Exercise on RI was conducted independently by two reviewers (Ivan Buljan and Rea Ščepanović).

1. Open Grey

Documents were found using the terms "research ethics" and "research integrity". We included only materials in English due to the possibility of a large number of retrieved irrelevant documents. The process of further screening of materials retrieved by the search was the same as for the materials from bibliographic databases.

2. CORDIS

Relevant projects were identified using the term "research integrity", and project documents were screened to identify suitable material.

3. WCRI

The search was performed on the web pages of the World Conferences on Research Integrity (WCRI). The aim was to identify official conference material as well as abstracts from lectures or PowerPoint presentations. Workshop materials were also screened. Abstracts, lectures and presentations that handled the subject of the specific practices for RI promotion were included.

4. ORI and ENRIO

The search was performed by screening files containing official codes, guidelines and other practices for RI promotion.

5. The National Academies of Sciences, Engineering, and Medicine

The search was performed of National Academies of Sciences, Engineering, and Medicine's book 'Fostering Integrity in Research'.

6. Science Europe

The search was performed on the web pages of the Science Europe to identify documents published by the Science Europe Working Group on Research Integrity.

7. Mutual Learning Exercise on Research Integrity

The search was performed on the web pages of the European Commission to identify documents published by the Mutual Learning Exercise on Research Integrity working group.

## 4.6.5. Data extraction

Data extraction of the material obtained in bibliographic databases search, after identifying articles for full-text analysis, was mapped into the following categories:

- Author(s)
- Title
- Include (yes/no)
- Reason for exclusion
- Year
- Reference type
- Journal
- Country
- Field of science (Humanities, Social sciences, Natural sciences (including engineering), Biomedical sciences, Research in general)
- Whether the document is more related to RPOs or RFOs or both
- Title of the practices
- Whether SOPs in the article refers to code/guideline/checklist/legal act
- The type of materials (informative/descriptive, interactive, research materials, legislative)
- Empirically grounded (yes/no)
- Project related (yes/no); the title of the project
- Whether SOPs are more related to institutions or individuals or equally to both
- For which population the SOP is intended for (researchers, students, supervisors, funders, policymakers, members of the research committees, integrity officers)
- Research theme (research planning, research performing, research reporting)

Mapping also included the categories as DOI, URL and PDF in order to provide the information on the availability of the documents.

Documents obtained from the grey literature search were mapped in the following categories:

- Name of the document
- Year

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- Country
- Field of science (Humanities, Social sciences, Natural sciences, Biomedical sciences, Research in general)
- Type of the resource (policy, statement, guideline, report, checklist, code, law, infographic, the checklist)
- Whether the document is more related to RPOs or RFOs or both
- For which population the SOP is intended for (researchers, students, supervisors, funders, policymakers, members of the research committees, integrity officers)
- Description of the material
- Link to the online version of the material.

The categorisation of documents was performed by two team members (Rea Ščepanović and Ivan Buljan). In cases of disagreement or question, the consensus was reached after consultations with the third team member (Ana Marušić).

## 4.7. Results

Records identified from Scopus, WoS, Medline, and PsycINFO (n=32,887)

Additional records identified from Open Grey (n=482)

After removing duplicates:

- from Scopus, WoS, Medline, and PsycINFO (n=26,805)

- from Open Grey (n=482)

Records screened:

- from Scopus, WoS, Medline, and PsycINFO (n=26,805)

- from Open Grey (n=482)

Records excluded:

- from Scopus, WoS, Medline, and PsycINFO (n=26,675)

- from Open Grey (n=475)

Full-text documents assessed for eligibility:

- from Scopus, WoS, Medline, and PsycINFO (n=130)

- from Open Grey (n=7)

Full-text documents excluded:

- from Scopus, WoS, Medline, and PsycINFO (n=70)

- from Open Grey (n=3)

Documents included in the synthesis:

- from Scopus, WoS, Medline, and PsycINFO (n=60)

- from Open Grey (n=4)

References of documents included in synthesis - Scopus, WoS, Medline, PsycINFO (n=6)

**Additional documents from WCRI, CORDIS ORI, ENRIO, National Academies, Science Europe, and MLE (n=106).**

Reasons for exclusion of 70 documents:

- the document was not found (n=11),

- the document could not be translated (n=2),

- there was no mention of RI practices (n=16),

- there was no description of RI practices (n=18),

- the document was a commentary with no connection to new RI practices (n=9),

- the document was already included (n=3),

- the document was only a proposal (n=5),

- the document was a plan for the development of the procedure (n=2),

- the document was related to academic integrity and not research (n=1),

- the document presented outdated practices (n=1),

- the document provided only recommendations (n=1),

- the document presented procedures for journals and editors (n=1)

- the documents present practices not related to RI (n=1)

- the document refers to the update of procedures, but without describing the update (n=1)
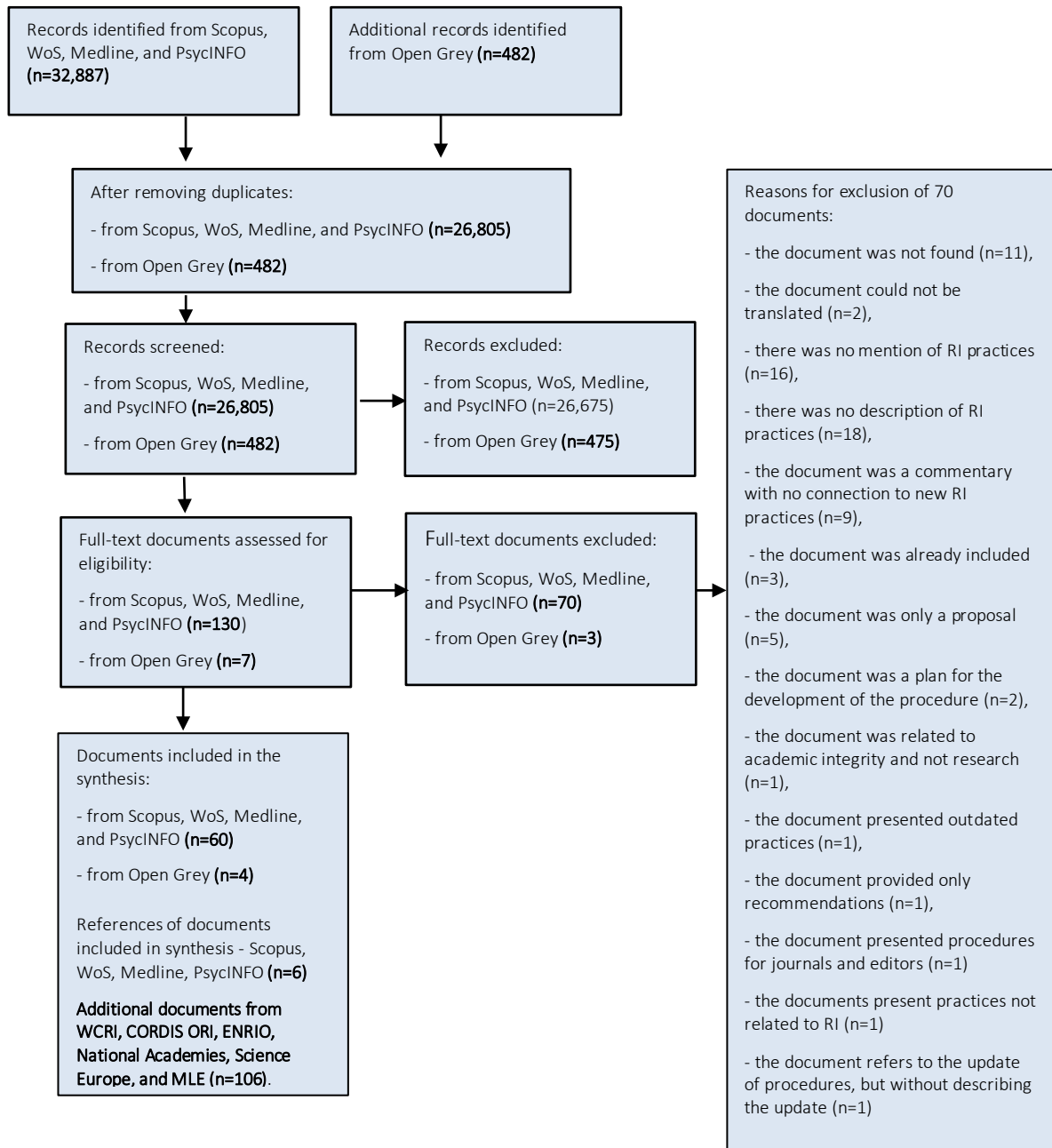
**Figure 3.** PRISMA-ScR flow diagram for the scoping review process

The search of Scopus, WoS, Medline, and PsycINFO retrieved 32,887 documents, of which 26,805 remained after removing duplicates. After screening of the titles and abstracts, 130 items were selected for full-text assessment. In the next step, 70 documents were excluded, leaving 60 for the analysis. Of the 70 excluded documents, 11 could not be identified due to the unavailability of the full-text documents. They were marked as "not found". Two articles were in a language other than English and we were unable to obtain translation. The reasons for the exclusion of 57 articles are presented in **Figure 3**.

The screening of the references of the 60 included documents identified 6 more documents for the analysis. Full-text assessment of the 6 additional documents demonstrated that they were guidelines, white papers, statements and declarations.

The search of Open Grey database retrieved 482 documents. After screening the titles, 475 documents that did not meet the inclusion criteria were excluded. We were unable to find 3 full-text documents, which left 4 documents for the analysis.
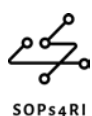
A search performed on the web pages of WCRI, ORI, ENRIO, CORDIS, National Academies, Science Europe, and MLE on RI identified 106 documents for the analysis.

## 4.7.1. Origin of the practices identified in all documents

The origin of practices for RI promotion, recognised in all included documents was observed in the context of the country of origin, the field of science, and institution to which they relate. The list of countries from which guidance documents originated is presented in **Table 4**. Some documents contained a description of practices for RI promotion related to more than one country.

Table 4. Number of identified documents by origin

| COUNTRY | NO. OF DOCUMENTS |
|---|---|
| USA | 56 |
| UK | 28 |
| Europe | 20 |
| International | 16 |
| The Netherlands | 10 |

| | |
|---|---|
| Australia | 7 |
| Canada | 7 |
| Norway | 6 |
| Austria | 4 |
| Denmark | 3 |
| South Africa | 3 |
| Spain | 3 |
| France | 2 |
| Germany | 2 |
| India | 2 |
| Japan | 2 |
| Estonia | 1 |
| Finland | 1 |
| Ireland | 1 |
| Lithuania | 1 |
| Nepal | 1 |
| Nigeria | 1 |
| Poland | 1 |
| Romania | 1 |

In terms of the scientific field, we categorized the documents into five categories. These included the 4 major disciplinary fields: *Humanities*, *Social sciences*, *Natural sciences*, *Biomedical sciences*, and "*Research in general*", which included more general documents, i.e. not developed for a specific field and could be applicable to research in general. Most of the analysed documents were related to RI practices developed for all fields of science,

i.e. Research in general (n=103) and Biomedical sciences (n=63). We found 6 documents related to practices for RI promotion in Social sciences, 5 documents in Natural sciences, 2 documents for both Biomedical and Natural sciences, 1 document for both Biomedical and Social sciences, and 1 document for Social sciences and Humanities.

The category of institutional origin refers to whether documents and practices for the promotion of RI described in documents were more related to or developed for RPOs or RFOs or both. Documents were mostly related to RPOs (n=116). These documents addressed RI promotion in RPOs in two directions. They reflected on the obligations and requirements that institutions, i.e. policymakers and other institutional bodies like ethics committees, should follow for the promotion of RI within the organisation. For example, this included policies on developing and implementing a data management plan, developing and implementing other policies to serve as guidance for researchers, developing procedures for the investigation of research misconduct or highlighting principles of good research practice that will influence organisational climate. The second direction of guidance was focused on individual researchers and provided them with guidance on the course of action in line with RI principles. Documents related to RPOs also addressed funders as stakeholders, but the guidance contained in them was primarily for RPOs. We identified 8 documents in which emphasis was put on funders; the documents were developed to serve as guidance mainly for RFOs. Guiding principles for both RPOs and RFOs were identified in 57 documents.

## 4.7.2. Type of guidance for RI promotion identified in all documents

This category of data analysis referred to the form and content of the documents, based on the nature of guidance they provided to researchers or institutions. We identified 11 different categories for the type of guidance, as presented in **Table 5**. Some documents referred to more than one type of guidance.

**Table 5.** Type of guidance identified in documents

| TYPE OF GUIDANCE | NO. OF DOCUMENTS |
|---|---|
| Guideline | 122 |
| Code | 41 |
| Legal act | 13 |
| Checklist | 7 |
| Policy | 7 |
| Report/guidelines | 7 |
| Declaration | 3 |
| Flowchart | 2 |
| Statement/guidelines | 5 |
| White paper/guidelines | 1 |
| Training material/guidelines | 1 |

## 4.7.3. Target groups to which guidance documents were directed

Regarding different stakeholders involved in research and addressed in documents, we grouped documents into three main categories: researchers, funders and policymakers. The three main categories were broadened by additional categories of students (PhD), supervisors/mentors and members of the research committees, as they were explicitly addressed in the documents. The stakeholders addressed in guidance documents are presented in **Table 6.** Most of the documents addressed more than one stakeholder.

**Table 6.** Stakeholders addressed in the documents

| TYPE OF STAKEHOLDER | NO. OF DOCUMENTS |
|---|---|
| Researchers | 148 |
| Policymakers (including RPOs) | 90 |
| Funders | 53 |
| Students | 32 |
| Members of committees (REC, IRB) and research integrity officers | 27 |
| Supervisors/mentors | 9 |

RPO – research performing organisation, REC – research ethics committee, IRB – internal review board

### 4.7.4. Themes identified in the documents

During the analysis, we identified broader themes represented in the documents and various sub-themes that were explicitly addressed and mentioned most often across most documents. Since in most cases, documents addressed each aspect of the research process, it was hard to divide them explicitly. Six broader themes were identified – research planning, research performing, research evaluation, research reporting, misconduct, and promotion and implementation of practices for RI. We further identified sub-themes and grouped them into a single main theme. List of themes and sub-themes is presented in **Table 7**.

**Table 7**. List of identified themes and sub-themes

| RESEARCH PLANNING |
|---|
| Sub-themes: |
| o    project preparation |
| o    research design |
| o    risk and benefits of research |

| | |
|---|---|
| o | guidance for grant application in the context of RI |
| o | authorship in research planning |
| o | ethical issues in research |
| o | data management – requirements by funders for data management plan |
| **RESEARCH PERFORMING** | |
| Sub-themes: | |
| o | data management - FAIR principles<br>        - data protection<br>        - privacy issues<br>        - processing and storage of research material<br>        - informed consent for data collection and processing |
| o | guidance for clinical trials |
| o | collaborative research |
| o | ethics in animal research |
| o | ethics in research with human subjects |
| o | mentoring/supervising |
| **RESEARCH EVALUATION** | |
| Sub-themes: | |
| o | peer review |
| o | research monitoring |
| o | protocol evaluation |
| o | quality assurance |
| **RESEARCH REPORTING** | |
| Sub-themes: | |

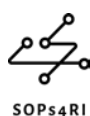| |
|---|
| o authorship – gift and ghost |
| o manuscript writing |
| o dissemination of the results |
| o data publication |
| o responsible reporting |
| o application of the research results |
| o transparency in funding (origin of the funds) |
| **PROMOTION AND IMPLEMENTATION OF PRACTICES FOR RI** |
| Sub-themes: |
| o training, education, and teaching – RI, RCR or RE |
| o principles of good research/scientific practice (existence of codes and other documents for the promotion of RI) |
| o institutional and individual responsibilities in RI |
| o disclosure of conflict of interest |
| o open access |
| o guidance on development of policies for RI promotion |
| o guidance on implementation of policies for RI promotion |
| o guidance on relevant legislative |
| o guidance for research committees |
| o ethical guidelines |
| o emphasising principles and moral values that researchers should strive to |
| o uniformity of guidelines among different institutions |
| **RESEARCH MISCONDUCT** |

| Sub-themes: | |
|---|---|
| o | conflict of interest |
| o | investigation of cases of research misconduct: handling cases, evidence management, and sanctions |
| o | violations of RI, definitions of fabrication, falsification, and plagiarism (FFP) |
| o | questionable research practices (QRP) |
| o | procedures for submitting a complaint |
| o | incentives; how sponsors may incentivise research misconduct |
| o | the role of research integrity officers |
| o | whistleblowing |
| o | image manipulation |
| o | bias in research |
| o | the problems that may occur during the researchers' mobility to a different organisation |

## 4.7.5. List of documents included in the analysis

The list of documents included in the final analysis is presented in **Table 8**. The list includes documents from databases Scopus, Medline, Web od Science, and PsycINFO and documents obtained from Open Grey, Cordis, WCRI, ORI, ENRIO, National Academies of Sciences, Science Europe, and Mutual Learning Exercises on Research Integrity.

**Table 8**. List of documents included in the analysis

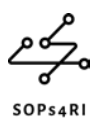| |
|---|
| Lune H, Pumar ES, Koppel R. Perspectives in social research methods and analysis; Section III: Ethics in Social Research; Policies and procedures 1997. Thousand Oaks: SAGE Publications, Inc; 2010:160-166. |
| Guidelines for dealing with faculty conflicts of commitment and conflicts of interest in research. July 1990. Association of American Medical Colleges Ad Hoc Committee on Misconduct and Conflict of Interest in Research. Acad Med. 1990;65:487-96. |

Standards for authorship and publication in academic radiology. AUR Ad Hoc Committee on Standards for the Responsible Conduct of Research. Am J Roentgenol. 1993;161:899-900.

Guideline for agreements at the initiation of research projects. Danish Committee on Scientific Dishonesty. Dan Med Bull. 1999;46:61-3.

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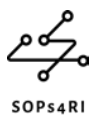National Science Foundation. Research Misconduct Policy. Alexandria; US: The Foundation; 2002. Available from: https://www.nsf.gov/oig/_pdf/cfr/45-CFR-689.pdf.

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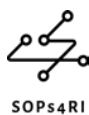| |
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## 4.8. Conclusion

In this scoping review, we explored the existing knowledge on practices for research integrity promotion in RPOs and RFOs. Most of the included material dated from the year 2000 onwards (152/177 documents). The majority of documents dating before 2000 originated from the field of Biomedical sciences. However, if we look at the new documents and developed practices, questions regarding ethics and integrity in research are not limited to one particular scientific field but rather to research in general. This shows that research integrity is important for every scientific discipline and adherence to RI principles should be something for everyone involved in the research to strive.

Although a large number of practices identified in this review referred to research in general, there is still a lack of RI practices originating from the Humanities or Social sciences. The review identified only 8 documents relating explicitly to research in Social sciences and Humanities.

Based on the results, the lack of guidelines can also be observed from the perspective of funders. RPOs and RFOs both have an important role in scientific progress and in fostering research integrity (7). Most documents identified in this review contained guidelines that were primarily intended for RPOs. We found only 8 documents that were focused mainly on funders. We also found 56 documents in which both RPOs and RFOs obligations toward research integrity were addressed, but the majority of these documents presented the duties of RFOs in a general manner. It seems that there is a need for RI guidance for RFO, evidences in the small number of practices for RFOs, as well as for the initiatives that RFOs can undertake to promote RI and prevent misconduct. Only a small number of the explored documents provided examples on what funders already do to foster RI. If we look at the newest documents in the **Supplement B**, dating from 2018 or 2019, a lot of emphasis is put on data management, investigations of research misconduct, education and training, open access, reproducibility, incentives, and mobility. Data management practices have become

particularly important for the European countries after the GDPR[16] regulation was implemented across the EU in 2018. More emphasis is put on processing, collecting, and protection of personal data in guidance for responsible research. The question of mobility of researchers, i.e. when the researcher changes the institutions at the national or international level, can be one of the challenges for developing new SOPs and guidance for RI. SOPs4RI aims to build a toolbox of the practices for the promotion of RI that can be used among different organisations. This means we have to take into account differences that may exist among different organisations and cultures and bring them together in the way that will serve their purpose best, i.e. promote RI but also handle cases of misconduct in a proper manner.

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# 5. Future steps for the SOPs4RI

D3.2 presents the findings from scoping reviews and develops a multi-level model of research culture. The aim of this deliverable was to build a basis on which further work to achieve the overall objective of the SOPs4RI will be conducted. The findings presented in this deliverable will be further used and explored by the Delphi study, and the addressed gaps will be taken into account in the process of the toolbox development.

In the first scoping review concerning the factors that influence the implementation of the practices for RI promotion in RPOs and RFOs, we divided these factors based on their relevance for the researchers, organisations, and the research system, into individual, institutional, and research system factors. They can also be perceived as factors that influence three different levels – micro, meso, and macro. With exploring factors referring to different levels, we also explored the factors' positive or negative impact on the implementation of the practices for RI promotion.

The factors identified in this review were mainly negative, showing that the scientific community still combats these issues regarding RI. Because of the interrelatedness of these factors, it is essential that initiatives are taken on all the three levels – micro, meso, and macro. Regulations at the macro level (the policies of national governments and RFOs) influence decisions and local cultures at the meso level (research centres, RPOs, groups, departments, and RFOs) which create everyday practices among researchers (micro level) that may challenge RI. The change will not come by focusing solely on the individual researcher – the micro level.

To achieve a change, it was important to get insight on practices for the promotion of RI that already exist. These practices will be used for developing SOPs that organisations will be able to select according to their needs. The review on practices for RI promotion in RPOs and RFOs showed that Biomedical sciences have already done a lot, which is demonstrated by a large number of existing codes and guidelines for researchers in that scientific field. Although a large number of practices identified in this review referred to research in general, there was still a lack of RI practices originating from the Humanities or Social sciences.

The lack of guidelines is characteristic for funders as well. Although RFOs engage on the macro level, because of their importance within the research system and their influence on RI, funding institutions have to work on developing and implementing policies for the promotion of RI. These policies can be used to impose RI principles to RPOs when they apply for funding.

Findings presented in D3.2 are the first step on the path of developing SOPs for RI. For the successful development and implementation of SOPs in RPOs and RFOs, we have to take into account differences that may exist among different organisations and cultures and bring them together in the way that will serve their purpose best. This could be made possible by using a mixed-methods, co-creative approach to the development and empirical validation of SOPs and guidelines.

# 6. Appendix A. Search strategies for scoping reviews

## 6.1. Scopus

(TITLE-ABS-KEY(research W/3 (integrity OR ethics OR conduct OR misconduct OR malpractice OR manipulation OR fraud* OR honest*))) OR (TITLE-ABS-KEY((scientific OR academic) W/3 (fraud OR ethics OR integrity OR misconduct OR honesty OR dishonesty))) OR (TITLE-ABS-KEY((researcher* OR scientist*) W/3 (integrity OR honest*))) OR (TITLE-ABS-KEY((publication* or publishing) W/3 (ethics OR plagiari* OR falsif*)) OR (TITLE-ABS-KEY((author* OR contribut*) W/3 (undeserv* OR ghost OR guest OR gift*)))) AND ((TITLE-ABS-KEY(code W/3 (ethic* or conduct)) OR (TITLE-ABS-KEY(educat* OR teach* OR train* OR motivat* OR instruct* OR interven* OR promot* OR supervis* OR mentor*)) OR (TITLE-ABS-KEY(course* OR seminar* OR workshop*)) OR (TITLE-ABS-KEY((program* OR plan* OR policy OR rule* OR procedure* OR standard* OR code*) W/3 (formulat* OR develop* OR improve* OR expand*))) OR (TITLE-ABS-KEY(quality control))) AND (TITLE-ABS-KEY((ethics or research or grant or grants) W/3 (committee or committees or commission or commissions))) OR (TITLE-ABS-KEY(research W/3 (organisation* OR organization*)) OR (TITLE-ABS-KEY(universit$ or college or colleges)) OR (TITLE-ABS-KEY (universit* AND (faculty or faculties or school or schools or department or departments or laboratory or laboratories or lab or institut or institute or institutes))) OR (TITLE-ABS-KEY(academic or academia or higher education*)))))

## 6.2. Web of Science

# 20   #19 AND #13 AND #6

# 19   #18 OR #17 OR #16 OR #15 OR #14

# 18   TS=(academic OR academia OR higher education*)

# 17   TS=(universit* AND (faculty OR faculties OR school OR schools OR department OR departments OR laboratory OR laboratories OR lab OR institut OR institute OR institutes))

# 16   TS=(universit* OR college OR colleges)

# 15   TS=(research NEAR/3 (organisation* OR organization*))

# 14 TS=((ethics OR research OR grant OR grants) NEAR/3 (committee OR committees OR commission OR commissions))

# 13 #12 OR #11 OR #10 OR #9 OR #8 OR #7

# 12 TS=(quality NEAR/3 control*)

# 11 TS=((program* OR plan* OR policy OR rule* OR procedure* OR standard* OR code*) NEAR/3 (formulat* OR develop* OR improve* OR expand*))

# 10 TS=(course* OR seminar* OR workshop*)

# 9 TS=(educat* OR teach* OR train* OR motivat* OR instruct* OR interven* OR promot* OR supervis* OR mentor*)

# 8 TS=(code NEAR/3 (ethic* or conduct))

# 7 TS=(guideline*)

# 6 #5 OR #4 OR #3 OR #2 OR #1

# 5 TS=((author* OR contribut*) NEAR/3 (undeserv* OR ghost OR guest OR gift*))

# 4 TS=((publication* OR publishing) NEAR/3 (ethics OR plagiari* OR falsif*))

# 3 TS=((researcher* OR scientist*) NEAR/3 (integrity OR honest*))

# 2 TS=((scientific OR academic) NEAR/3 (fraud OR ethics OR integrity OR misconduct OR honesty OR dishonesty))

# 1 TS=(research NEAR/3 (integrity OR ethics OR conduct OR misconduct OR malpractice OR manipulation OR fraud* OR honest*))

## 6.3. Medline

1 Scientific Misconduct/ (5023)

2 Fraud/ (7036)

3 exp Ethics, Research/ (7574)

4 (research adj3 (integrity or ethics or conduct or misconduct or malpractice or manipulation or misleading or mispresent$ or bias$ or fraud$ or honest$ or reliab?l$ or fair$ or impartial$ or selective$)).tw. (15995)

5 ((scientific or academic) adj3 (fraud or ethics or integrity or misconduct or malpractice or manipulation or honesty or dishonesty)).tw. (2418)

6 ((researcher$ or scientist$) adj3 (integrity or honest$)).tw. (92)

7 Plagiarism/ (1214)

8 (plagiari$ or falsif$).tw. (3121)

9 Publication Bias/ (4693)

10 Duplicate Publication as Topic/ (757)

11 Retraction of Publication as Topic/ (594)

12 Peer Review, Research/ (6325)

13 (data adj3 (interpretat$ or inaccura$ or inadequa$ or deceptive or deceit or bias$ or impartial or manipulat$ or misus$ or misleading or mispresent$ or mistreat$ or selective or suppress$ or fabricat$ or fraud$ or falsif$ or false)).tw. (27201)

14 Research Report/ (2769)

15 (report$ adj3 (selective or deceptive or deceit or misleading or inadequate or independent)).tw. (6958)

16 (research adj3 (underreport$ or under-report$)).tw. (43)

17 ((publication$ or publishing) adj3 ethics).tw. (485)

18 (bias adj3 (publication$ or publishing or analys#s or design)).tw. (13061)

19 (publication$ adj3 (rendundant or duplicate or multiple or salami or undeserving)).tw. (875)

20 (inaccura$ adj3 citation$).tw. (17)

21 Authorship/ (5535)

22 ((author$ or contribut$) adj3 (undeserv$ or ghost or guest or gift$)).tw. (258)

23 Conflict of Interest/ (9252)

24 (interest adj3 (conflict or competing)).tw. (4281)

25 or/1-24 (108903)

26 exp guideline/ (31503)

27 guideline$.tw. (304028)

28 exp "Codes of Ethics"/ (5164)

29 (code adj3 (ethic$ or conduct)).tw. (2457)

30 exp Education, Professional/ (282429)

31 exp Teaching/ (80510)

32 exp Curriculum/ (79237)

33 Mentors/ (9918)

34 (educat$ or teach$ or train$ or motivat$ or instruct$ or interven$ or promot$ or supervis$ or mentor$).tw. (2738959)

35 (course$ or seminar$ or workshop$).tw. (612665)

36 Policy/ (2054)

37 exp Policy Making/ (24148)

38 Program Development/ (27358)

39 ((program$ or plan$ or policy or rule$ or procedure$ or standard$ or code$) adj3 (formulat$ or develop$ or improve$ or expand$)).tw. (181855)

40 Quality Control/ (46654)

41 (quality adj3 control$).tw. (50594)

42 or/26-41 (3811000)

43 exp Ethics Committees/ (9027)

44 ((ethics or research or grant or grants) adj3 (committee or committees or commission or commissions)).tw. (13582)

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45 (research adj3 organi#ation$).tw. (8560)

46 Universities/ (36926)

47 (universit$ or college or colleges).tw. (416213)

48 (universit$ and (faculty or faculties or school or schools or department or departments or laboratory or laboratories or lab or institut or institute or institutes)).tw. (106436)

49 (academic or academia or higher education$).tw. (129189)

50 or/43-49 (560208)

51 25 and 42 and 50 (6001)


## 6.4. PsycINFO

1 fraud/ (809)

2 professional ethics/ (18329)

3 (research adj3 (integrity or ethics or conduct or misconduct or malpractice or manipulation or misleading or mispresent$ or bias$ or fraud$ or honest$ or reliab?l$ or fair$ or impartial$ or selective$)).tw. (11366)

4 ((scientific or academic) adj3 (fraud or ethics or integrity or misconduct or malpractice or manipulation or honesty or dishonesty)).tw. (1345)

5 ((researcher$ or scientist$) adj3 (integrity or honest$)).tw. (77)

6 plagiarism/ (240)

7 (plagiari$ or falsif$).tw. (2533)

8 peer evaluation/ (2761)

9 peer review$.tw. (7868)

10 (data adj3 (interpretat$ or inaccura$ or inadequa$ or deceptive or deceit or bias$ or impartial or manipulat$ or misus$ or misleading or mispresent$ or mistreat$ or selective or suppress$ or fabricat$ or fraud$ or falsif$ or false)).tw. (7597)

11 (report$ adj3 (selective or deceptive or deceit or misleading or inadequate or independent)).tw. (1707)

12 (research adj3 (underreport$ or under-report$)).tw. (17)

13 ((publication$ or publishing) adj3 ethics).tw. (183)

14 (bias adj3 (publication$ or publishing or analys#s or design)).tw. (2638)

15 (publication$ adj3 (rendundant or duplicate or multiple or salami or undeserving)).tw. (150)

16 (inaccura$ adj3 citation$).tw. (13)

17 ((author$ or contribut$) adj3 (undeserv$ or ghost or guest or gift$)).tw. (452)

18 Conflict of Interest/ (564)

19 (interest adj3 (conflict or competing)).tw. (1343)

20 or/1-19 (54985)

21 guideline$.tw. (58798)

22 (code adj3 (ethic$ or conduct)).tw. (2909)

23 education/ (32620)

24 teaching/ (42029)

25 curriculum/ (25054)

26 mentor/ (5836)

27 (educat$ or teach$ or train$ or motivat$ or instruct$ or interven$ or promot$ or supervis$ or mentor$).tw. (1395167)

28 (course$ or seminar$ or workshop$).tw. (200665)

29 exp policy making/ (68897)

30 exp program development/ (8798)

31 ((program$ or plan$ or policy or rule$ or procedure$ or standard$ or code$) adj3 (formulat$ or develop$ or improve$ or expand$)).tw. (67869)

32 quality control/ (1434)

33 (quality adj3 control$).tw. (3335)

34 or/21-33 (1597178)

35 ((ethics or research or grant or grants) adj3 (committee or committees or commission or commissions)).tw. (2402)

36 (research adj3 organi#ation$).tw. (8713)

37 colleges/ (13109)

38 (universit$ or college or colleges).tw. (327580)

39 (universit$ and (faculty or faculties or school or schools or department or departments or laboratory or laboratories or lab or institut or institute or institutes)).tw. (45016)
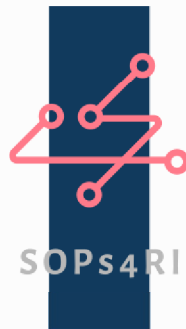
40 (academic or academia or higher education$).tw. (156810)

41 or/35-40 (451152)

42 20 and 34 and 41 (5330)

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