Member Organisation Forum

European Peer Review Guide

Integrating Policies and Practices into Coherent Procedures

European Science Foundation

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- Joint strategy development and strategic cooperation with regard to research issues of a European nature.
- Development of best practices and exchange of practices on science management, to benefit all European organisations and especially newly established research organisations.
- Harmonisation of coordination by MOs of national programmes and policies in a European context.

Acknowledgements

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The MO Forum has been chaired by Marc Heppener (ESF) and coordinated by Laura Marin (ESF).

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Contents

Foreword

Excellence in research depends on the quality of the procedures used to select the proposals for funding. Public and private funding organisations at the national and international levels face the challenge of establishing and maintaining the best procedures to assess quality and potential. This is a demanding task as each proposal is scientifically unique and originates from varying research cultures. As a result, many different systems and criteria are currently in use in European countries. In order to address the issue of peer review collectively, the common needs have to be specified first. The needs then have to drive development of policies that are both convergent and complementary, whereafter coherent procedures can be conceived, promoted and implemented.

The Heads of the European Research Councils (EUROHORCs) and the European Science Foundation (ESF) recognised in their *Vision on a Globally Competitive ERA and their Road Map for Actions* the need to develop common peer review systems that are useable, credible and reliable for all funding agencies. To identify the *good practices* of peer review, the governing bodies of both organisations invited the ESF Member Organisation Forum on peer review to compile a Peer Review Guide to be disseminated to their members and other interested stakeholders in Europe and beyond. The Forum included over 30 European research funding and performing organisations from 23 countries, with the partnership of the European Commission and the European Research Council. The Forum established dedicated working groups, ran workshops and undertook a comprehensive survey on the peer review systems and practices used by research funding and performing organisations, councils, private foundations and charities. The results served to identify good practices across Europe on the evaluation of grant applications for individual and collaborative research projects.

Consequently, this Peer Review Guide illustrates practices currently in use across the members of ESF and EUROHORCs, while also reflecting the experiences of the European Commission in its Framework Programmes. It describes good practices by setting a minimum core of basic principles on peer review processes commonly accepted at a European level. In addition to the quality of the basic procedures, peer reviewers and organisations face other challenges such as assessing multidisciplinary proposals and defining the appropriate level of risk inherent in frontier research. The management of peer review of proposals by large international consortia poses yet another challenge, and this is why the Guide has been designed to address the assessment procedures of large scale programmes such as Joint Programming.

This Guide should serve to benchmark national peer review processes and to support their harmonisation, as well as to promote international peer review and sharing of resources. It should be considered as a *rolling reference* that can be updated and revised when necessary.

ESF wishes to acknowledge the key contributions of its Member Organisations to the development of this Guide.

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Part I
Overview of the Peer Review System

1. Introduction

Research funding bodies are charged with delivering public spending programmes in the pursuit of objectives set at the national level. In the basic interests of good governance, it is incumbent on these bodies to ensure that their funding decisions are accountable and target the most deserving research activities in accordance with the programme objectives, and that the process for doing this delivers value for money to the public. To ensure that funding decisions are fair and credible, research agencies use experts in a *peer review* or *expert review* process to identify research proposals for subsequent funding.

This *European Peer Review Guide* draws on European and international good practice in peer review processes, and seeks to promote a measure of coherence and effectiveness in the form of a practical reference document at the European level. While applicable to national settings – in Europe and beyond – it also aims to engender *integrity* and *mutual trust* in the implementation of transnational research programmes. The content of the Guide has been shaped by input from the representatives of more than 30 European research funding and performing organisations who participated in the ESF Member Organisation Forum on Peer Review. In addition, a comprehensive survey on peer review practices targeted at the ESF member organisations as well as other key organisations has been conducted in order to benchmark and identify good practices in peer review. The analysis and conclusions of the survey have also served as evidence in drafting this Guide and its recommendations. The results of the survey are available as Appendix 2 of this document and through the ESF website at: http://www.esf.org/activities/mo-fora/peer-review.html.

The Guide presents a minimum set of basic core principles commonly accepted at a European level, including those of the EU Framework Programme. It also presents a series of good practices, identifying possible alternatives where appropriate. It is intended to be useful to European research funding and performing organisations, councils, private foundations and charities.

The Guide addresses the peer review processes of grant applications for selected funding instruments that comprise the majority of European research programmes and initiatives, for example, *Individual Research Programmes, Collaborative Research Programmes* or *New Research Infrastructures Programmes*. In addition to the specific scope and nature of each funding instrument, there may be programmatic or operational variants of the instruments as practised in different countries across Europe. For example, thematic versus non-thematic, responsive versus non-responsive, and monodisciplinary versus pluridisciplinary can be considered as variants for the different funding instruments.

This Guide is divided into two parts: the common principles and building blocks of the practice of peer review are set out in Part I. More detailed and explicit recommendations applying to particular funding instruments are provided in Part II.

1.1 Key definitions

In order to facilitate the establishment of a common set of terminologies for the purpose of interpreting the content of this Peer Review Guide, a few key definitions are provided in the Appendix 1: Glossary.

1.2 Applicability

This document is aimed at any organisation involved in funding and performing research, notably:

- Public research funding organisations;
- Research performing organisations;
- Research councils;
- Private foundations;
- Charities.

The Guide has been developed in a European context, but will be largely relevant beyond the continent. The suggested guidelines are designed to promote common standards that adhere to accepted good practices on a voluntary basis. In particular, they aim to support intergovernmental or inter-organisational activities through the identification and establishment of benchmarks and prevailing approaches necessary to manage multi-stakeholder programmes.

The applicability of the Guide stops at the level of granting of the awards. Hence, for example, ex-post evaluation of funded research – which generally has strong reliance on peer (or expert) review – has not been explicitly included in the Guide[1].

1.3 How to use this Guide

In order to make the best use of this document, readers with a general interest in the subject are recommended to browse through the chapters of Part I. The content of the first Part is structured according to three thematic and easily recognisable areas: the first comprises an introduction to peer review in a general sense (Chapter 1); a typology of funding instruments (Chapter 2); and the pillars of good practice in peer review (Chapter 3). A second area focuses on peer review methodology (Chapter 4, from Sections 4.1 to 4.10) and a third area specifically describes the variants of the funding instruments and their implication for peer review (Sections 4.11 to 4.13).

Science management practitioners with the intention of gathering concrete information on good practices specific to the peer review of particular funding instruments are advised first to review the chapters of Part I, with particular attention given to Chapter 4, and then to consult their programme of interest in the corresponding chapter in Part II. The chapters of Part II are meant to provide information on the state-of-the-art and benchmarking of peer review practices specific to the selected funding instruments.

1. For ex-post evaluation, see the ESF Member Organisation Forum on Evaluation of Funding Schemes and Research Programmes' activities, in particular the report: *Evaluation in National Research Funding Agencies: approaches, experiences and case studies,* at: http://www.esf.org/index.php?eID=tx_nawsecuredl&u=0&file=fileadmin/be_user/CEO_Unit/MO_FORA/MOFORUM_Evaluation/moforum_evaluation.pdf&t=1296135324&hash=9a6f476733d58e8f9ff738ceb755bf08

2.
Typology of funding instruments

Characterising the appropriateness of peer review practices can be meaningful only when considered in the context of the specific programmes or funding instruments to which they must apply. Therefore, in order to establish common approaches and understanding of the practices of peer review, it is necessary to establish common definitions and meanings in the context in which they are to be used. This context is defined by various funding opportunities with specific objectives that different organisations have developed in order to select competing proposals and to allocate merit-based funding using clearly defined objectives and selection criteria. In this document, these funding opportunities are referred to as 'funding instruments'.

Across European countries, all major funding instruments that rely on peer review as their main selection tool have been considered for inclusion in the Guide (see Table 1, below). However, based on the input received from the ESF Member Organisation Forum on Peer Review and the results of the ESF Survey on Peer Review Practices, the final list of instruments elaborated in Part II of the Guide excludes two of the instruments outlined in the table below, namely *Knowledge Transfer* and *Major Prizes and Awards*.

Brief descriptions of typical funding instruments are provided in the next section, while the specific peer review process for each of them is elaborated in Part II. Many of these funding instruments or programmes have different variations in terms of scope and disciplinary characteristics. Therefore, a separate section is devoted to elaborating on these features. When these variants have noticeable implications on the practice of peer review, they are further elaborated in Chapter 4, or in the corresponding chapters of Part II.

Instrument	Description
Individual research projects	Funding line dedicated to proposals submitted by a single investigator or a group of investigators in the same team. These proposals typically include only one set of self-contained research goals, work plan and budget.
Collaborative research projects	Funding line dedicated to proposals comprising groups of applicants enhancing national/international collaboration on specific research projects.
Career development opportunities	Funding line dedicated to supporting career progression of researchers and scholars through awards, fellowships, appointments, professorships, Chairs, etc.
Creation of centres or networks of excellence	Funding line dedicated to proposals submitted by a large group of researchers and targeting the establishment of institutional or regional centres, or networks for given areas of research.
Knowledge transfer and dissemination grants	Funding line dedicated to projects supporting the transfer of results from science to industry or other private/public sectors.
Creation or enhancement of scientific networks	Funding line dedicated to promoting networking of researchers in the form of meetings, conferences, workshops, exchange visits, etc.
Creation or enhancement of research infrastructure	Funding line dedicated to financing development, enhancement, maintenance and/or operation of research infrastructures.
Major prizes or awards	Funding line dedicated to rewarding outstanding contributions of a single researcher and/or a group of researchers.

Table 1. List of typical funding instruments

2.1 General description of main funding instruments

(see Table 1 above)

2.2 Variants of funding instruments

The main scope and objectives of some of the funding opportunities mentioned in the previous section may be tailored through policy or strategy considerations, giving rise to specific variations. Some of the main categories identified are briefly described here.

2.2.1 Non-solicited (responsive mode) versus solicited funding opportunities

Regardless of the nature of a funding instrument (scope, objectives and target applicants), the timing and frequency of the call can vary from organisation to organisation or from programme to programme. In this sense, two variants of any typical funding instrument may be envisaged as: (a) when applicants submit their proposals to a call for proposals with a fixed duration and specified date for its opening; these are solicited funding opportunities, also known as 'managed mode'[2] funding. (b) When the call for proposals for a given funding line is continuously open and ideas are submitted in an unsolicited manner; this is known as 'responsive mode' funding in some research councils[3,4]. In terms of the process of peer review and selection of proposals, there are some differences between the two modes that will be described in Chapter 4, §4.11.1.

2.2.2 Thematic versus non-thematic focus

Another variant of most typical funding instruments can be considered to be the thematic (or topical) versus non-thematic (open) scope of the call for proposals. Thematic opportunities can be used for strengthening priority areas of research that the funders may identify through their sci-

2. See Biotechnology and Biological Sciences Research Council, BBSRC Research, Innovation and Skills Directorate, "BBSRC Research Grants. The Guide, October 2010", p. 9 in: http://www.bbsrc.ac.uk/web/FILES/Guidelines/grants_guide.pdf
3. See Natural Environment Research Council: http://www.nerc.ac.uk/research/responsive/
4. See Engineering and Physical Sciences Research Council (EPSRC): http://www.epsrc.ac.uk/funding/grants/rb/Pages/default.aspx

ence policy or strategic plans. In some programmes, themes of research areas or topics may themselves be identified by investigators using peer review and through calls for proposals. Some councils use so-called 'signposting' for flagging priority areas in their responsive mode funding streams. The implication of a thematic versus non-thematic nature of a call for proposals on the process of peer review is not very significant but will be briefly discussed in Chapter 4, §4.11.2 of this Guide.

2.2.3 Monodisciplinary versus pluridisciplinary focus

For the purposes of fine-tuning and sharpening the process of peer review according to the scope of the proposals, it may be of interest to categorise proposals into 'monodisciplinary' and 'pluridisciplinary' when appropriate. Research proposals increasingly draw on knowledge and expertise outside of one main discipline. In some programmes, there are no specific modalities incorporated to deal with pluridisciplinary proposals while other instruments may be designed to specifically foster and manage these kinds of research.

Currently in the specialised literature there are ongoing discussions on the different types of pluridisciplinary research [5]. For the purposes of this Guide the term 'pluridisciplinary' may be used in the widest sense, *i.e.*, research proposals that *clearly* and *genuinely* require expertise from a broad range of different disciplinary domains. However, for completeness, a brief review of the types of pluridisciplinary research as described in the literature is provided in Chapter 4, Section 4.12 of this Guide [6,7]. In the same section relevant peer review specificities and recommendations for the assessment of these types of research proposals are also described.

2.2.4 Breakthrough research

Breakthrough research aims at radically changing the understanding of an existing scientific concept, and could lead to changes of paradigms or to the creation of new paradigms or fields of science. The level of risk associated with the success of these projects is generally higher than mainstream research, *i.e.*, research activities that in general lead to incremental gains with lower risks of failure.

The survey on peer review practices shows that 70% of the respondents do not have instruments specifically designed for breakthrough proposals, and 20% of the organisations have only one such dedicated instrument [8]. While 33.3% of the responding organisations have reported that they regularly see breakthrough proposals in their conventional instruments, 50% of them have stated that they see this type of proposal only rarely [9].

Explicit identification and handling of breakthrough research is generally more complex than mainstream research. In the context of research subjects, priorities and goals, breakthrough research is characterised not only by exceptional potential for innovation, and creation of drastically new knowledge, but also by consciously acknowledging and taking the associated risks [10]. This can have implications for the process of peer review as briefly described in Chapter 4, Section 4.13 in this Guide.

5. See Lattuca (2003) or Aboelela (2007).
6. See Frodeman, Thompson Klein and Mitcham (2010).
7. See UNESCO (1998), *Transdisciplinarity 'Stimulating synergies, integrating knowledge'*.

8. See European Science Foundation (2010b), *ESF Survey Analysis Report on Peer Review Practices*, in particular §3.12.1, Question 67: "How many funding instruments does your organisation have which are dedicated exclusively to breakthrough proposals?"
9. See European Science Foundation (2010b), *ESF Survey Analysis Report on Peer Review Practices*, in particular §3.11.2, Question 69: "How often does your organisation see breakthrough proposals within your conventional instruments, *i.e.* instruments not specially dedicated to breakthrough proposals?"
10. See Häyrynen (2007), p. 11.

3. Pillars of good practice in peer review

Based on a comprehensive review of the existing practices and the available literature[11], five elements are identified as key supporting pillars of good practice in the edifice of peer review (see Figure 1). These pillars will ensure that the overall processes, procedures and operational steps including decisions are of high levels of quality, equity and public accountability without being excessively rigid, bureaucratic, inefficient and costly.

The central pillar consists of a set of *core principles* that are commonly accepted by the relevant organisations engaged in peer review. These are the key guiding principles that need to be safeguarded in order to achieve credible, equitable and efficient peer review. Four other pillars that have been identified are: safeguarding of the integrity of the process; sound methodology; strong means of assuring quality; and appropriate governance structure.

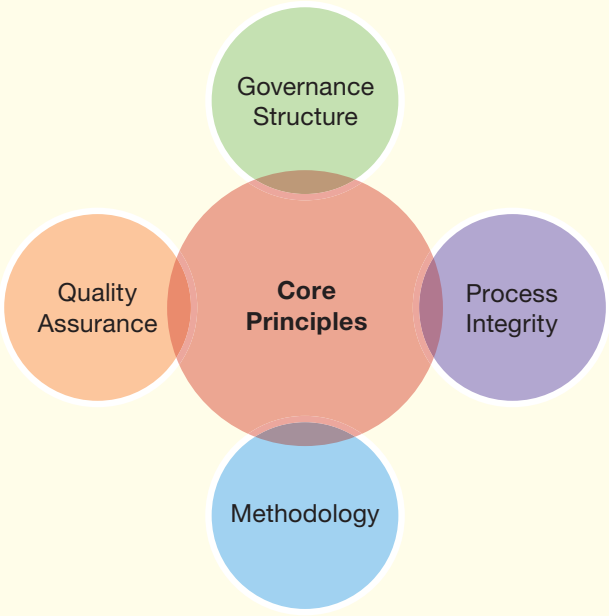

Figure 1.
Five pillars supporting good practices of peer review with quality and equity

3.1 Core principles of peer review

Guiding principles have been defined and used by various organisations that deal with peer review. Although there are strong similarities between different sets of these principles, there are also slight differences in their scope and formulations. For the purpose of this Guide, it is necessary to adopt a set of principles as the guiding framework, in which peer review standards are anchored.

The list of the seven core principles presented below (Table 2) are included in the Peer Review Framework Conditions for the EU's Joint Programmes[12]. It also covers the items identified and elaborated by the ESF Member Organisation Forum on Peer Review.

Although identifying core principles as the central pillar for good practice in peer review is a necessary step, it will not be sufficient without ensuring other organisational and procedural ingredients necessary for realising good practice. As mentioned above, four other supporting pillars are briefly described in the following sections.

11. See the list of references at the end of this document.

12. See European Research Area Committee, High Level Group for Joint Programming: *Voluntary guidelines on framework conditions for joint programming in research 2010*, Annex, at: http://register.consilium.europa.eu/pdf/en/10/st01/st01309.en10.pdf

1. Excellence	Projects selected for funding must demonstrate high quality in the context of the topics and criteria set out in the calls. The excellence of the proposals should be based on an assessment performed by experts. These experts, panel members and expert peer reviewers should be selected according to clear criteria and operate on procedures that avoid bias and manage conflicts of interest.
2. Impartiality	All proposals submitted must be treated equally. They should be evaluated on their merits, irrespective of their origin or the identity of the applicants.
3. Transparency	Decisions must be based on clearly described rules and procedures that are published *a priori*. All applicants must receive adequate feedback on the outcome of the evaluation of their proposal. All applicants should have the right to reply to the conclusions of the review. Adequate procedures should be in place to deal with the right to reply.
4. Appropriateness for purpose	The evaluation process should be appropriate to the nature of the call, the research area addressed, and in proportion with the investment and complexity of the work.
5. Efficiency and speed	The end-to-end evaluation process must be as rapid as possible, commensurate with maintaining the quality of the evaluation, and respecting the legal framework. The process needs to be efficient and simple.
6. Confidentiality	All proposals and related data, intellectual property and other documents must be treated in confidence by reviewers and organisations involved in the process. There should be arrangements for the disclosure of the identity of the experts.
7. Ethical and integrity considerations	Any proposal which contravenes fundamental ethical or integrity principles may be excluded at any time of the peer review process.

Table 2. Set of core principles of peer review

3.2 Integrity of the process of peer review

All research institutions (research funding and performing organisations as well as academies and universities) have the role and the obligation to promote relevant research and good research practice and to ensure the integrity of their conduct [13].

Fundamental principles of good research practice and peer review are indispensable for research integrity [14,15]. Funding organisations and reviewers should not discriminate in any way on the basis of gender, age, ethnic, national or social origin, religion or belief, sexual orientation, language, disability, political opinion, social or economic condition.

Integrity of the peer review process should be ensured through appropriate resources, policies and practices, management interventions, as well as training and monitoring, such that in essence we can "*say what we do and do what we say we do*". To this end, upholding the advertised set of core principles is a cornerstone of the integrity of the process. Different organisations have various means of assuring integrity of their practices; however, there are common basic principles that must be incorporated. Flexibility and pragmatic interpretations may be exercised only with extreme care and according to the context and without ignoring the core meaning of these principles or violating their spirit. Furthermore, the flexibility exercised in the sphere of one principle should not violate or come into conflict with other principles.

To safeguard integrity it is absolutely essential to avoid discretionary decisions and changes. Effective and transparent communication is a crucial element in safeguarding the integrity of any multi-stakeholder system such as peer review. Therefore, guidelines on integrity must be formulated and promoted to help all parties implicated

13. See European Commission (2005), *The European Charter for Researchers*.
14. See European Science Foundation (2010a), *Fostering Research Integrity in Europe*, pp. 8-9.
15. See European Commission (2005), *The European Charter for Researchers*, p. 11.

in the peer review process, namely, applicants, reviewers, panels, committee members, Chairs, programme officers and staff. These principles include[16]:

- Honesty in communication;
- Reliability in performing research;
- Objectivity;
- Impartiality and independence;
- Openness and accessibility;
- Duty of care;
- Fairness in providing references and giving credit;
- Responsibility for the scientists and researchers of the future.

3.2.1 Conflicts of interest

The prevention and management of conflicts of interest (CoIs) are the most important ingredients for ensuring equity and integrity in peer review, and to preserve the credibility of the process and that of the responsible organisation. A CoI involves the abuse or misuse – be it actual, apparent, perceived or potential – of the trust that the public and the clients must be able to have in professionals and administrators who manage or can influence decisions on research funding.

A CoI is a situation in which financial or personal considerations have the potential to compromise or bias the professional judgement and objectivity of an individual who is in a position to directly or indirectly influence a decision or an outcome. In fact, CoIs are broadly divided into two categories: intangible, *i.e.*, those involving academic activities and scholarship; and tangible, *i.e.*, those involving financial relationships[17].

In peer review it is important to set out in advance in as much detail as possible those conditions that are deemed to constitute *perceived* and *real conflicts of interest*. It may be appropriate to distinguish conditions that would automatically disqualify an expert, and those that are potential conflicts and that must be further determined or resolved in the light of the specific circumstances. To uphold the credibility of the process, both real and perceived conflicts should be addressed.

Typical disqualifying CoIs might relate to:

- The expert's affiliation;
- Whether he or she stands to gain should the proposal be funded (or not);
- Personal or family relationship with applicant;
- Research cooperation/joint publications/previous supervisory role.

In these situations, the reviewers should avoid assessing a proposal with which they have conflicts of interest. In the case of panel discussions, these individuals should not be present when the proposal in question is being discussed.

While every effort should be made to avoid having reviewers assessing proposals with which they have a potential CoI, there may be circumstances where these situations can be resolved or mitigated without fully excluding the reviewer with a declared conflict. For example, when the expertise of all parties in a review panel is needed, and provided that the potential CoIs of individuals have been declared and recorded, it may be decided to allow the reviewer(s) to assess the proposal and/or participate in the panel discussion. In this situation the individual(s) with the potential conflict should clearly state their own disposition on whether or not their views are biased and continue their participation only if they clearly state that despite the potential conflict they do not feel biased in any way.

The rules for CoIs may vary according to the stage of the evaluation, and the role of the expert. For every proposal evaluated, each expert must sign a declaration that no CoI exists, or must report such a condition to the responsible staff member. While agency staff must be alert at all times, there should be a strong measure of trust exercised with respect to the invited experts and their honesty and objectivity.

3.2.2 Managing confidentiality

Each expert should sign a code of conduct before the start of the evaluation process. The code should deal both with the requirement to declare any CoI (see above), and with the obligation to maintain the confidentiality of the information when required.

Measures to avoid leaks of confidential information (both deliberate and inadvertent) include: secure IT systems (password, etc.); watermarks; restricted use of WIFI, GSM, etc. when appropriate. The appropriate measures will depend on the stage of the evaluation, and on the sensitivity of the research topics under review. Differing levels of transparency are also important for a good and impartial peer review. We can broadly identify three systems:

- **Double-blind review:** the identity of both the reviewers and of those being reviewed is kept confidential from each other;
- **Single-blind review:** the identity of the applicants

16. See European Science Foundation (2010a), *Fostering Research Integrity in Europe*, p. 6.
17. See Columbia University (2003-2004), *Responsible Conduct of Research: Conflict of Interest*.

being reviewed is revealed to the reviewers but not *vice versa;*

- **Open review:** the identity of both the reviewers and of the applicants being reviewed is revealed to each other.

According to the peer review survey, single-blind reviews are predominantly used across most organisations in most of the programmes; for example, for *Individual Research Programmes* the identity of individual/remote reviewers is not disclosed to the applicants in 80% of the organisations; while in 62% of the organisations the identity of the panel reviewers is not disclosed to the applicants[18]. However, in some Scandinavian countries as noted by the members of the ESF Member Organisation Forum on Peer Review, the situation can be very different as national legislations may call for full transparency when dealing with public funding and peer review.

3.2.3 Applicants' rights to intervene

It is of utmost importance for a credible peer review system to provide one or both of the following features to ensure that the applicants have the right to understand the basis of the decisions made on their proposals and consequently to be able to influence the outcome of such decisions in cases where these are made based on incorrect or inaccurate information, or influenced by factual errors or wrongdoing.

- **Right to appeal** or **redress:** this feature allows the applicants to appeal at the end of the selection process after the final decision is made. The appeal is normally made to the funding organisation or to a dedicated independent office based on a known and transparent process of redress. Through the process of redress the applicants do not influence the peer review during the selection process, but can object to its outcome. In a general sense, redress only concerns the evaluation process or eligibility checks and applicants cannot question the scientific or technical judgement of the reviewers. Depending on the situation and in the case where decisions have been made incorrectly, the applicants should be given another chance with a fresh review of their proposal.
- **Right to reply:** in contrast with redress, the 'right to reply' is included as part of the peer review process itself. It is normally applied to two-stage peer review systems where a panel of experts makes a selection, prioritisation or ranking of proposals based on external referee assessments. Feedback and intervention from applicants are not provided to amend or elaborate the initially submitted proposals or to change them in any way. It is only meant to allow the applicants to identify and comment on possible factual errors or misunderstandings that may have been made by the referees while assessing the proposal. The external referees as well as the applicants and the members of the review panels should be made fully aware of the procedures and timing related to the 'right to reply' stage (more details on this feature can be found in §4.7.4 of this Guide).

3.3 Quality assurance

Another important pillar for ensuring good practice is the adoption of explicit means of assuring quality in all relevant aspects of the process and operations.

In order to assure quality of the process and procedures, it is necessary to monitor and measure the quality of the main products and services provided based on known criteria and indicators. For monitoring quality the following elements may be used:

- Staff members with an explicit mandate within the organisation;
- Dedicated office within the organisation;
- Dedicated committees or boards outside of the organisation.

According to the survey on peer review practices, the quality of the peer review system is often assured through external *ad hoc* or standing committees (47.7% of respondents), or by a group of staff members with an explicit mandate (46.7% of respondents). Only 6.7% of the respondents reported that there is a dedicated office with an explicit mandate for assuring quality in their organisation[19].

3.4 Governance structure

Another supporting pillar for achieving and maintaining good practice in peer review is the presence of strong governance that is put in place to ensure organisational and operational coherence and quality. Some of the key features of a good governance

18. SeeEuropean Science Foundation (2010b), *ESF Survey Analysis Report on Peer Review Practices*, in particular Section 4.12, Tables 4.36 and 4.37.

19. See European Science Foundation (2010b), *ESF Survey Analysis Report on Peer Review Practices*, in particular Section 3.2, Question 19: "What means does your organisation use for assuring the quality of its peer review system?" (Table 3.4).

structure are: effectiveness, clarity and simplicity. The governance structure is meant not only to ensure that all the relevant players and stakeholders are made fully aware of their roles and assigned tasks, their expected contributions and their responsibilities but also to ensure that all contributions are made according to the required standards and within the scheduled deadlines. Finally, the governance structure is meant to be able to hold the relevant bodies accountable for any deviations or shortfalls.

Some of the main attributes of credible and effective governance are outlined below:

- Identification of the relevant actors, and clarification of the scope and levels of their responsibilities (*e.g.*, decision makers, clients such as researchers and the public, other stakeholders such as regional or national governments);
- Definition of roles and responsibilities of the key actors: programme officers, management committees, review panels, other decision making or consulting panels (such as ethical panels or monitoring panels or committees), readers, external observers, etc.;
- Definition and dissemination of key decision making processes and approval processes;
- Definition and dissemination of procedures to effect continuous improvement through appropriate changes to the process;
- Availability and effective allocation of the required resources (financial, human resources, technical recourses and infrastructure, etc.);
- Terms of reference and, if possible, code of conduct for all the participants (terms of appointment, confidentiality agreement, declaration of conflict of interest, integrity code, etc.).

3.5 **Methodology**

The final important pillar for achieving good practice in peer review is the actual adopted methodologies and approaches for conducting peer review. Since it is under 'methodology' that the main building blocks and common approaches of peer review are described, a dedicated chapter, Chapter 4, is provided to illustrate the different steps and the sequential order of the peer review process in a general sense.

4.
Peer review methodology

In this chapter an overall methodology is suggested that is based on the most common approaches and good practice in use across various organisations and for different types of instruments. It breaks down the overall process into the main sub-processes or building blocks at the highest level as illustrated in Figure 2. This is the scheme of the peer review process across the entire set of instruments covered in this document.

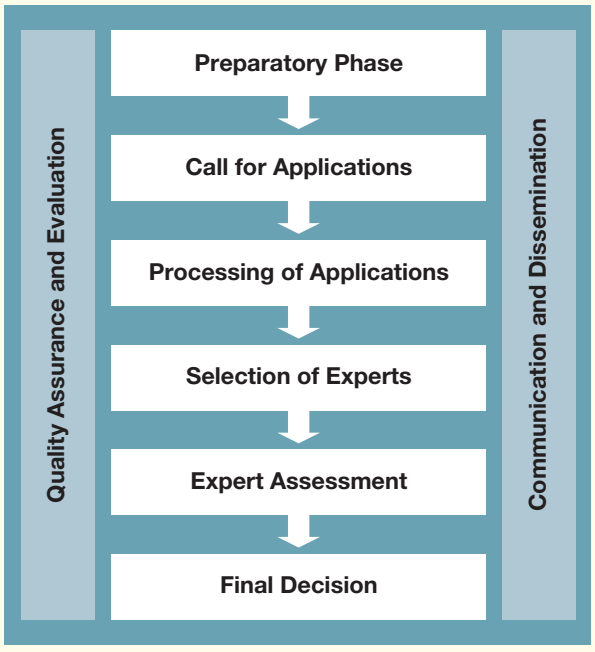

Figure 2.
High-level process description of a typical peer review system

In what follows, each of the main sub-processes illustrated above will be described separately in the form of a general model. For particular funding instruments the models described in this chapter need to be *instantiated* and elaborated to suit the specific needs and characteristics of the required peer review for a given instrument. This is done in Part II where for each instrument a dedicated chapter is provided, outlining an end-to-end cycle with the required details.

The variants of the typical funding instruments described previously in Chapter 3 can also impose specific nuances and variations on the requirements of the peer review process. These variations are described in a general sense at the end of this chapter while further instrument-specific fine-tuning of the practice based on variations of the types of instrument is described in the corresponding chapter of Part II as appropriate.

4.1 Preparatory phase

In this section a summary of all the elements required for consideration, preparation and elaboration before the launch of a given programme is provided[20]. The preparatory phase is marked by a mandate and decision to launch or re-launch a funding instrument and ends when all technical, organisational and procedural components are in place and ready for being launched. The intensity and duration of the preparatory phase varies from instrument to instrument and depends on whether

20. To complement this chapter, a guide on call implementation in the context of ERA-NETS can be found here: http://netwatch.jrc.ec.europa.eu/nw/index.cfm/static/eralearn/eralearn.html

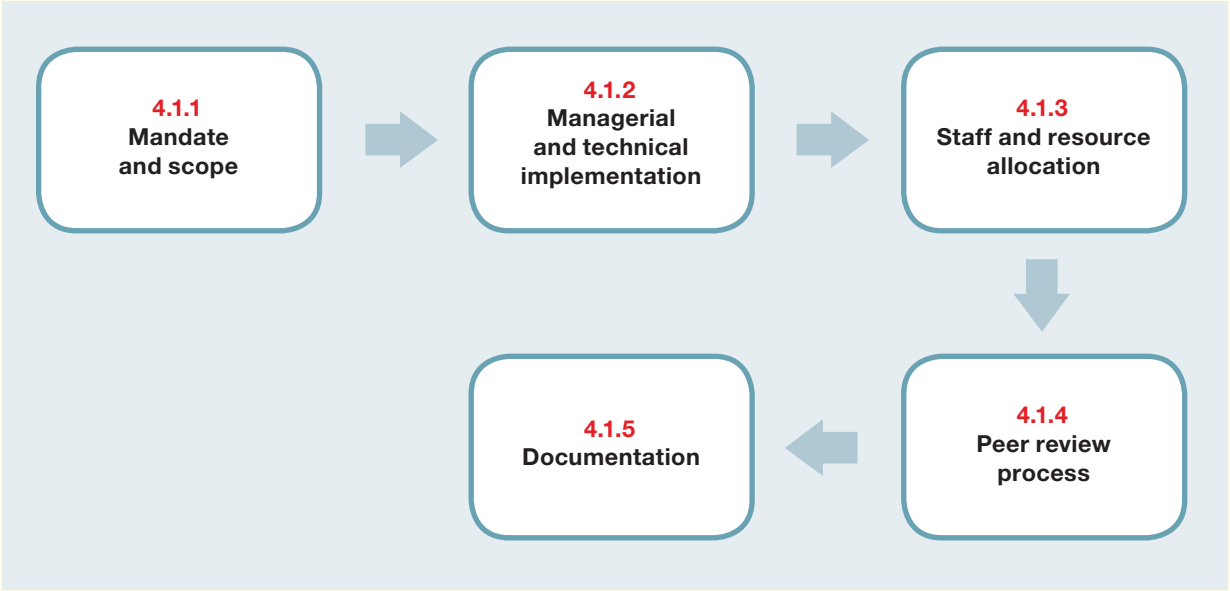

Figure 3. Preparatory phase

or not the programme is responsive or solicited. However, for a given instrument that recurs periodically (*e.g.*, annually) the duration and intensity of the activities in this first phase are diminished since resources, information, knowledge and tools will be reused as long as major changes are not necessary.

For those instruments that are launched for the first time or for one-off programmes, or in situations where major changes are applied to existing funding streams, this phase may be considerably longer and more involved. Some of the main sub-processes of the preparatory phase are outlined here in Figure 3.

Under each sub-process included in Figure 3 and described below, the list of items that need to be considered is also provided. These lists are not exhaustive but cover the most typical aspects used across different organisations.

4.1.1 Mandate and scope

In order to establish the programme efficiently and coherently, the following aspects need to be clearly defined by the responsible bodies and communicated to all relevant parties:

- Programme needs;
- Programme objectives;
- Overall programme budget;
- Potential stakeholders (beneficiaries, clients, decision makers and other relevant parties);
- Performance measures (if required);
- Research classification system (if required);
- Typology of funding instrument or variants (if required).

4.1.2 Managerial and technical implementation

Once the mandate and scope of the programme are clearly established and understood, the responsible organisation, department(s), or group(s) of staff is charged with establishing the required technical and managerial components needed to implement or run the programme. Some of these are listed below:

- Work plans and logistics;
- Human resources;
- Detailed budget for distribution and indicative budget for peer review;
- Timeline;
- Other resources (information systems, facilities, databases, etc.);
- Overall decision making process;
- Roles and responsibilities, delegation of authority, procedures for approval and sign-offs.

4.1.3 Staff and resource allocation

Having established the mandate, scope and higher levels of organisational structure and assignments, responsible departments, groups and units will take charge. Some of the items necessary to keep in mind are listed below:

- Task allocation;
- Budget allocation;
- Assign roles and responsibilities (contact points for applicants, check of eligibility, conflict of interest, completeness of the application, reviewer assignment);
- Programme and science officers have a pivotal role before, during and after the peer review process.

The responsible staff will therefore need to have a level of education and training in research that gives them not only credibility but also equips them with the basic knowledge and intellectual tools to understand the field of research and research activity; these aspects need to be complemented by strong managerial skills.

4.1.4 Peer review process

Once the responsibilities are assigned and the nature of the programme and its objectives are established, an appropriate, fit-for-purpose peer review process has to be defined. To this end, the following items need to be considered:

- Main stages of the required peer review process: one-stage submission of full proposals, versus two-stage outline proposals (or letters of intent) followed by full proposals. Outline proposals are normally sifted through by a dedicated panel, committee or board. Full proposals normally go through a complete peer review either in one or in two or more steps, *i.e.*, either selection through remote assessments or using remote reviewers plus review panel;
- Main features of the required peer review model: overall decision making process using panels, individual/remote (external) reviewers, other committees (for prioritisation, funding, etc.), expert readers, observers, redress or rebuttals, whether or not re-submissions are accepted and their conditions if any, etc.;
- Operational details and lower-level requirements such as timelines, workflow, reporting, communication, etc.;
- Assessment process: identify specific features such as the nature and number of assessors, the source of identifying experts, multidisciplinary considerations, work load for external experts, and panel members including rapporteurs, etc.;
- Schemes for the flow of information and documentation, necessary IT tools and resources (web pages, online submission forms, guidelines, etc.);
- Process monitoring and evaluation, including audits, observers and feedback to relevant sponsoring or commissioning parties and clients.

4.1.5 Documentation

All documents (including guidelines, manuals and reports) must be comprehensive and provide all the necessary information, and at the same time they must be efficient and as short as possible. Some of the main features for effective documentation are:

- Availability and clarity of all relevant documents on funding instruments and specific guidelines and manuals for applicants;
- Availability of all relevant manuals, guidelines or Standard Operating Procedures for the staff members responsible for the management of the peer review at various stages;
- Availability of all the relevant documents defining the process, and the roles/responsibilities of the various actors to reviewers, members of the panels and committees.

A list of commonly required documents is provided below:

- *Call for Proposals (call text)*: the call for proposals normally comprises two main parts: first, the scientific part which describes the scope and objectives of the programme; defines the scientific context; and outlines the scientific topics and subtopics to be covered. The second part of the call text describes the necessary programmatic aspects of the programme. It clearly describes the peer review process and its various stages. It defines the required format, length and language of the proposals, lists eligibility and assessment criteria, informs about the available budgets and eligible costs, and describes the timelines and main milestones throughout the process including various upcoming communications to applicants.
- *Guidelines* and *instructions to the applicants*: these documents should contain mandatory templates, predefined section structure, length per section, list of mandatory annexes and supporting documents, list of optional annexes, list of required signatures.
- *Reference documentation*: guidelines for applicants, reviewers and panel members, description of the governance structure, detailed description of the peer review process, description of selection and decision making processes including eligibility and assessment criteria, code of conduct, redress and right to reply procedures, proposal and consortium agreements if applicable, guidance on preparation of agreements or dealing with the issues regarding intellectual property and commercialisation.
- Frequently Asked Questions and glossaries.
- Online forms and web pages.

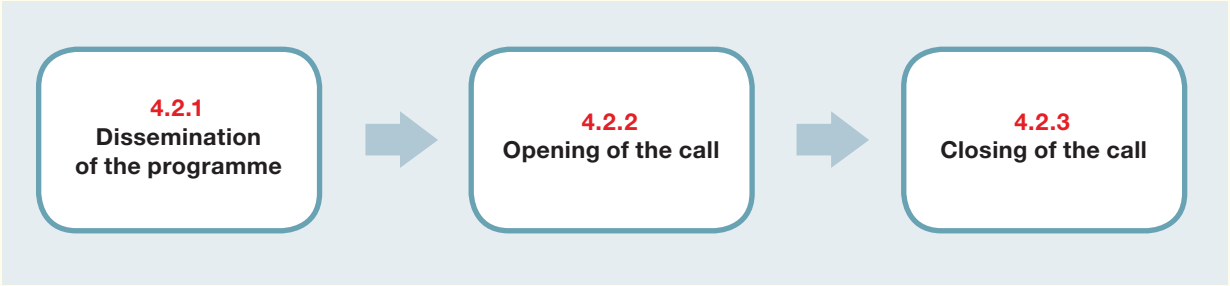

Figure 4. Launch of the programme

4.2 Launch of the programme

Once all the preparatory steps for the launch of solicited funding opportunities or programmes are in place and communicated, the actual opening and implementation phase can begin. In a general sense, the elements shown in Figure 4 need to be covered. For responsive mode programmes, where the call is continuously open, periodic communication and promotions are still necessary, although some of the steps described below may not apply.

4.2.1 Dissemination of the programme

In order to reach out to all the eligible applicants and reviewers and encourage participation, it is essential that the launch of the programme is disseminated through all the applicable means and in good time.

Groundwork for the dissemination of the opportunity should have started in the preparatory phase and be completed in this phase. A continuous dissemination of the call for proposals should be in place for responsive mode programmes. In addition, particular attention should be given to targeting the information streams to the appropriate communities, for example in the case of collaborative (national or international) research programmes, thematic or topical programmes, or for breakthrough research.

Some of the main means of disseminating the opportunity are:

- Web-based promotion;
- Advertisement in scientific media (newspapers, journals and magazines, etc.);
- Dedicated mailing lists to which researchers can freely subscribe.

4.2.2 Opening of the call for proposals

Calls should open at the stated date and time and a communication to all relevant parties and stakeholders should be made announcing the launch of the call. Before the actual opening of the call for proposals the following items should be already in place:

- The procedures and conditions by which funding decisions are to be made must be spelled out in the call documentation as described above;
- A clear plan of communication of the main decisions;
- As far as possible, dedicated and secure web pages and databases for online management of all the processes and interactions;
- Online and clear access to all documentation.

4.2.3 Closing of the call

The closing of the call has to be communicated as soon as possible to all stakeholders (such as the applicants, reviewers, staff members and other relevant parties). The announced deadline for the closing of the call has to be clearly stated well in advance as part of the preparatory phase and must be respected.

Postponing the deadline for the closure of the calls should be avoided and be considered only in very exceptional and unpredictable circumstances. In these situations, and especially if the extension can be seen as considerable for the applicants, efforts should be made to allow resubmission of proposals to all those applicants who had submitted their proposals at the time the extension was announced and who may wish to take advantage of the additional time given. At any rate, in the case of extensions, clear statements must be widely disseminated describing the reason for and nature of the extension.

Figure 5. Processing of applications

4.3 Processing of applications

In responsive mode programmes for which the call for proposals is continuously open, applications are processed in batches and therefore their timing cannot be determined in the same way as for the general case of solicited opportunities. For the latter it is possible to group the subsequent activities of the processing phase into the following three steps (Figure 5).

Depending on the size and scope of the programmes, proposals may be solicited in either one stage or in two stages. Hence, for one-stage calls the entire process must be completely described in the call, whereas for two-stage schemes a first call is issued through which promising ideas are selected and retained for a second round of submitting full proposals based on which final selection and funding decisions will be made.

The preliminary selection is normally done by a review panel based on outline proposals, or letters of intent. These outline proposals contain a short description of the nature and overall objectives of the research as well as indications on the required resources, infrastructures, budgets and the proposing team. The secondary stage is normally done using full proposals through a two-stage peer review system by remote assessment followed by review panel deliberation and ranking.

4.3.1 Eligibility screening

Eligibility screening is generally an administrative process, and is carried out by responsible members of the staff in the funding organisation. However, in some cases, notably in assessing eligibility in relation to the scientific scope of the call, scientific expert advice should be sought and used.

In the case of multidisciplinary or breakthrough (high-risk and high-return) research, it will also be necessary to involve scientific experts to screen proposals or letters of intent for eligibility.

Any eligibility criteria used to screen proposals must be defined and clearly stated in advance of the call and made available to all as part of the disseminated information. Eligibility criteria should not be open to interpretations and must be applied rigorously to all applicants in the same way. Some of the usual eligibility criteria used by funding organisations are listed below:

- Completeness of the proposal (inclusion of all requested information, documents, chapters, sections, annexes, forms and signatures);
- Timeliness of the submission;
- Eligibility of the applicants for receiving grants and for working in the host organisation;
- Eligibility of the scope of the research proposed in relation to the call;
- Ethical concerns (*e.g.*, applicable national and international regulations and directives on safety and security, embargos, use of animals and human subjects, controlled information, hazardous research, environmental considerations, etc.).

To uphold the principle of impartiality and to promote equal playing fields, eligibility screening should be conducted strictly and consistently. Applicants who have failed the eligibility checks should be informed as soon as possible.

4.3.2 Acknowledgment

During the phase of processing the submitted proposals, the applicants as well as other relevant stakeholders must be informed of the intermediate steps. Ideally, the steps below should be considered and included in the overall plan:

- Acknowledgment of receipt of the proposals giving information on the subsequent steps and communications;
- Acknowledgment of the eligibility screening as soon as it is determined. In the case of ineligible proposals, sufficient information describing the decision must be communicated;

- For the sake of transparency, it is advisable to inform the applicants of the general statistics on submission, *e.g.*, overall numbers received versus eligible proposals, etc.

4.3.3 Resubmissions

In some organisations, particularly for larger programmes, the eligibility checks do not immediately lead to non-compliance and exclusion of the proposals. In these situations, there may be a period of feedback and negotiation between the office and the applicants during which the ineligible applications are provided the opportunity to improve their proposals and to resubmit. This practice, if necessary, should be handled with great care, openly and diligently by competent and experienced members of the staff in order to avoid personal influences and inconsistencies. In these cases it is crucial to be fully transparent and consistent in applying known and clear criteria and in providing equitable opportunities and attention to all applicants consistently and to the same degree.

In most cases, however, the eligibility checks are final and determining, without the possibility of resubmission in the current call. For these situations, it is also necessary to be clear on the possibilities and means of resubmitting improved proposals in the next round of the call for proposals.

4.4 Selection and allocation of experts

One of the most important and challenging phases of the peer review process is to collect the required number of willing and available experts who would agree to conduct the task of expert assessments both as individual/remote reviewers and/or members of panels and committees as described below.

The activities to be undertaken for typical programmes are grouped under the following four steps (Figure 6).

4.4.1 Identification of the types of experts needed

Depending on the nature of the programme and the adopted peer review model, different types of expert referees and evaluators may be required. For example, there are instruments for which peer review is conducted by remote experts only. However, for the majority of the instruments both remote and panel review are used. Therefore it is first necessary to consider the types of experts needed. Evidently, this process should start in the preparatory phase, but be implemented during this phase.

Means of identification of expert reviewers

Funding organisations often have a database of reviewers which is structured based on a given and often multi-level research classification system (taxonomy of research profiles). As discussed below, with the advent of increasingly more advanced information management systems and tools, the original need for conventional multi-level classification systems may be reconsidered now. Currently, however, most of the existing operational systems across different science management organisations seem to rely on some kind of hierarchical structuring of research profiles in terms of disciplines and sub-disciplines.

The peer review survey shows that 90% of the organisations use a multi-level research classification system for the structuring of their research profiles and proposals. The results of the survey point to a strong tendency to rely on internal sources for the definition of these classification systems: for example, 50% of respondents rely on their organisation's staff; 39% on their scientific council, while 28.6% of the organisations use the system offered by the OECD *Frascati Manual*[21]. The data collected through the ESF Survey suggests that the current classification systems in place may not be fully compatible. To move towards more comparable and therefore more widely accepted common peer review practices, it is crucial that the *peer reviewers* are assigned scientific/expert profiles that can be interpreted clearly and without ambiguity across different organisations and their databases.

Furthermore, detailed analysis of the survey data suggests that those organisations that have indicated using the OECD *Frascati Manual* as the basis of their classification system have by and large also been more satisfied with the effectiveness of their classification system; this is in contrast to those that use internally defined classification systems[22].

Therefore, the use of commonly accepted systems such as the OECD *Frascati Manual* or of any other classification system that allows a unique mapping of the research profiles from one system into another without ambiguity should be encouraged;

21. See European Science Foundation (2010b), *ESF Survey Analysis Report on Peer Review Practices*, in particular Section 3.1, Question 11: "Does your organisation use a research classification system for the grouping of your proposals?" (Table 3.1) and Question 12: "What is the source of this classification?" (Figure 3.1). See also Appendix B to the Report: *Research Classification System: A preliminary map of existing European approaches*.
22. See European Science Foundation (2010b), *ESF Survey Analysis Report on Peer Review Practices,* Section 3.1, §3.1.4, Table 3.3.

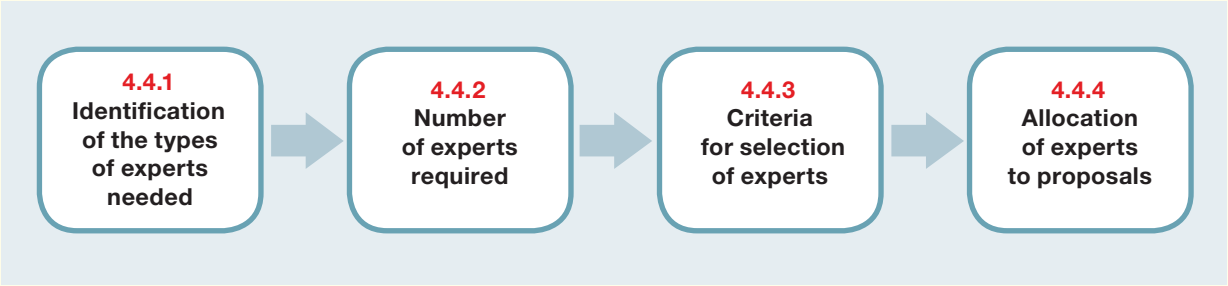

Figure 6. Selection and allocation of experts

this will help to create the needed ingredients for cross-referencing and therefore comparable interactions and collaborations at the European level.

Funding organisations normally use their 'conventional' research classification system in order to match the profiles of the required experts to the scientific scope of the proposals under review. This may be referred to as 'discipline matching' when selecting reviewers and it relies on updated, accurate and compatible research classification systems.

In contrast to this standard method and enabled by the adoption of more automated and more advanced information management systems, many organisations are considering the use of matching of *keywords* between proposals and reviewers' profiles. This means searching for reviewers in databases using electronic matching ('text mining') of keywords or key phrases stemming from the proposals to the keywords attached to the profiles of the reviewers within their dedicated database. This may be referred to as 'keyword matching'.

The two aforementioned methods have strengths in addressing the selection of reviewers in different ways. For example, 'discipline matching' may not be as effective in identifying specialised reviewers such as those needed for multi-, inter-, cross- and trans-disciplinary (MICT) proposals, whereas keyword matching will generally be more adequate in finding reviewers with particular research expertise. On the other hand, as described in Section 4.12, it may be advantageous to maintain disciplinary perspectives when dealing with peer review of MICT proposals. Hence, it may be quite advantageous to use the two schemes in conjunction and complementing one another.

Experts who take part in the peer review process

In a general sense there are two main groups of experts who take part in the peer review process:

- *External or individual remote reviewers* who assess the proposals on their own and separately from other members who may look at the same proposals. These reviewers do not discuss the proposals with anyone and provide their assessments using known and clear criteria and scores[23].
- *Members of review panels* who will collectively discuss and evaluate groups of proposals. The main function of the panel is to evaluate and consolidate external assessments by experts on a group of competing proposals and to rank or prioritise them based on clear and stated criteria and parameters. The review panel's contributions are normally needed within the last phase of the peer review as described in this Guide, *i.e.*, when final decisions are made. However, it is possible that in a one-stage peer review system, assessments of proposals are done by a panel.

It is important not to mix the two functions mentioned above and to keep the two groups separate as much as possible, *i.e.*, to have different individuals providing remote assessments from those who will participate in ranking, prioritisation or consolidation meetings in order to make sense of the multiple assessments for each proposal.

Four distinct formats can be used for setting up the remote and panel reviewers as illustrated in Figure 7. The results obtained from the ESF survey on peer review indicate that across all organisations that have responded and considering all funding instruments, the format of choice for constituting remote and panel membership is option A illustrated in Figure 7; the second choice has been identified as option B.

The nature and scope of the funding instrument will determine the required nature of the peer

23. One exception is the Commission's evaluation system for FP7 (non-ERC). Here, after the individual review, the experts concerned take part in an in-depth discussion of the proposal concerned, and draw up a consensus report of comments and scores. It is this consensus report, not the individual review, which is passed on to the panel review stage.

review bodies, although clearly a two-stage peer review comprising external assessments followed by a review panel deliberation is considered optimal and should be used as much as possible. For smaller programmes with narrower scientific scope lighter models can be used and therefore a one-stage review may be sufficient[24].

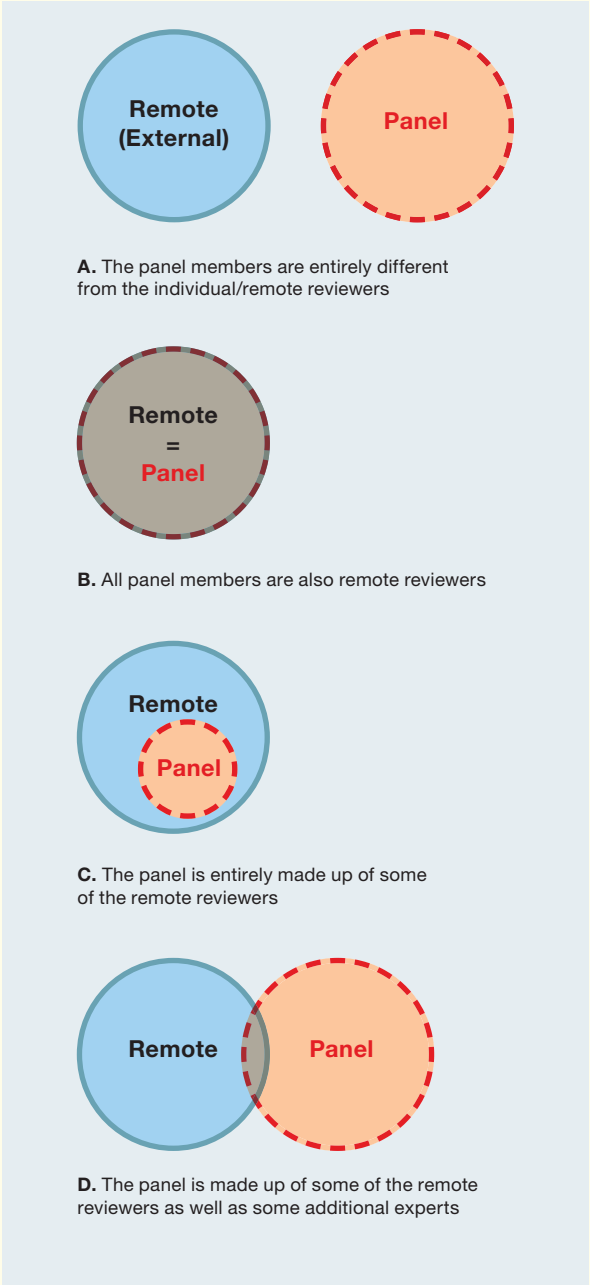

Figure 7. Types of reviewers

24. Part II of this Guide provides more specific information on this point.

RECOMMENDATIONS

- Invite non-European experts (it is also important to involve experts from emerging regions), both to ensure availability of scientific expertise and perspectives, and also to decrease the chances of conflicts of interest.
- Provide concise and clear instructions and guidance to the identified reviewers and panel members; this should cover all aspects of their involvement, including their tasks and contributions, requirements on conflicts of interest, confidentiality, language proficiency, etc.
- Provide as much advance notice to reviewers as possible, in order to increase chances of availability.
- Use dedicated and reliable information management systems including a reviewer database. The use of a common European database that would include its own quality assurance and possibly certification system would clearly help in promoting good practice.
- • • •

From the survey a need for a common European Reviewer Database (also known as 'College') emerges, which could better meet the growing demands for highly qualified and experienced reviewers and ensure their availability[25].

This is particularly evident for cross-border collaborations and mobility of scientists across Europe. Such a common database would have clear advantages and strengths by creating an opportunity to further develop the common methodologies, processes, criteria and requirements of peer review, and for the selection and assignment of reviewers across different nations. Moreover, through availability of this potential shared resource, common approaches in defining and managing conflicts of interest could be promoted and practised more extensively and consistently[26].

As a result of the ESF peer review survey, several research organisations have indicated their willingness to contribute to constituting such a database providing high-quality reviewers (63.3%) and then to frequently use the common database (46.7%)[27].

25. See European Science Foundation (2010b), *ESF Survey Analysis Report on Peer Review Practices*, in particular Section 3.4, §3.4.2, Question 34: "From your organisation's perspective, is there a need for a common European database?" (Figure 3.7).
26. Currently the European Commission maintains a database of experts in order to administer the Seventh Framework Programme. While this is its primary purpose, the database can be made available to other public funding bodies.
27. See European Science Foundation (2010b), *ESF Survey Analysis Report on Peer Review Practices,* in particular Section 3.4, Questions 35 and 36, Tables 3.15 and 3.16.

However, some concerns have also been expressed in the survey and by the members of the ESF Member Organisation Forum in relation to the cost and means of maintaining such a system.

4.4.2 Number of experts required

The minimum number of referees and possibly panel members assigned per proposal will depend on the format of peer review, number and size of the proposals expected, scientific scope of the programme, and the size of the grants requested.

The goal should be to ensure availability of diverse viewpoints, scientific perspectives and scholarly thinking. This is particularly important when preliminary assessments are to be generated for a subsequent panel stage prioritisation or ranking.

In general, the aim should be to provide at least three expert assessments before a final decision is made[28].

For the review panel stage that may follow remote assessments, it is recommended to assign rapporteurs from the panel to each proposal. For larger programmes, three rapporteurs are essential while for smaller programmes (in terms of size, scope, funding), one rapporteur may be sufficient.

4.4.3 Criteria for the selection of experts

It is important to identify the right individuals with the responsibility of selecting and inviting the experts. These persons should stay in contact with the reviewers from the beginning to the end of the process. They will treat all proposals and all reviewers in the same way and provide the same support and information to all.

As mentioned in the previous section, as an element of good practice in peer review, a safe distance should be maintained between panel membership and individual/remote reviewers. The choice of reviewers is usually under the responsibility of programme officers and through their own searches or suggestions from others such as the review panels or other advisory committees and boards, and applicants' suggestions of names either for possible inclusion or exclusion.

The goal should be to attract qualified reviewers with all the necessary attributes in proportion with the scope of the task. When required, selection of internationally recognised and leading scientists and researchers has to be encouraged and should be given a high priority for certain programmes, but this may not be feasible (or even necessary) for all peer review assignments across all funding instruments. Therefore, it is extremely important to pay some attention at the outset to defining the range of required expertise and levels of eminence and track record of the reviewers suitable for the task at hand.

Selection criteria for identification of individual/remote reviewers and panel members have to be defined and communicated to the responsible individuals. There are a number of possible features to keep in mind when selecting reviewers, some of which are:

- Scientific excellence, measured through contributions and track records;
- Coverage of the scope and objectives of the call;
- For membership of panels (especially for chairing them), it is necessary to include active researchers who are well established and who have broader disciplinary perspectives;
- Appropriate levels of expertise in relation to the nature of the task such that authoritative judgments and comments can be expected without excess;
- Level of familiarity/proficiency of the language used. This requirement applies substantially differently from discipline to discipline and according to the necessary levels of mastery of the language used;
- A solid record of publications: bibliometric indices are increasingly used for assessing publication track records. Care should be taken when applying these quantitative measures; these must be used as complementary information and not as sole determining factors in valuing publication track records. An authoritative and elaborate set of recommendations on the usage of bibliometric in peer review and evaluation is provided in a ministerial report prepared by the French Academy of Sciences[29];
- Previous participation in other research and academic adjudication committees;
- Diversity (gender balance, scholarly thinking, background, geography, turnover);
- Independence: external to the funding body;
- Conflict of interest: reviewers should not be from the same institution as the applicant(s). For very large institutions this requirement may be relaxed to some extent; reviewers should not have been a research supervisor or graduate student of the applicant during a period of at least 10 years preceding the application; have collaborated with the applicant or any of the co-applicants within

28. For details on the common practices across various funding instruments see Part II of this Guide and European Science Foundation (2010b), *ESF Survey Analysis Report on Peer Review Practices,* Chapter 4.

29. Institut de France, Académie des Sciences, *Du bon usage de la bibliométrie pour l'évaluation individuelle des chercheurs*, 17 January 2011 – http://www.academie-sciences.fr/actualites/nouvelles.htm.

the past five years; have plans to collaborate with them in the immediate future; be in any other potential conflict of interest, *i.e.*, personal, financial or immediate family-related;
- Selection of gender-balanced reviewers: conscious and explicit attention must be paid to ensuring gender balance for both remote and panel reviewers as well as in chairing panels according to national and European standard norms and objectives.
- Selection of international reviewers (outside the funding organisation's country) is considered good practice.
- When assessing scientific standing of the experts, attention should be paid to individual career paths and circumstances caused by career interruptions and changes, *e.g.* due to family reasons or inter-sectoral and non-academic mobility such as working for industry[30].

RECOMMENDATION

Provide equal playing fields

Effort should be made to consistently increase the number of representatives of the underrepresented gender in peer review activities where the percentage of the minority gender is less than 40% of the selected experts. For reviewers, it is therefore recommended that a gender ratio of at least 40% of women to men should be attained. Furthermore, individual "non-standard" career paths affected by changes or interruptions due to professional mobility and family-reasons should be considered when selecting experts.

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4.4.4 Allocation of experts to proposals

Experts are allocated to proposals on the basis of the best possible match between their expertise and the topics covered by the various proposals. Depending on the type of programme and the nature of the peer review process, the criteria used for allocating reviewers to proposals may differ. Disciplinary expertise and depth of knowledge of the field are crucial for providing remote assessments where the core of the evaluation is usually aimed at the scientific and intellectual merit of the proposal. However, for panel members it is not always necessary that every person who is assigned to a proposal is an expert and active researcher in every topic or aspect covered by the proposal; rather, as a group, the panel should collectively bring the overall perspectives and expertise needed to decipher the judgments of the remote specialists and possibly the views of the applicants in the case of rebuttals (see §4.7.4 for detail on rebuttals or the right to reply).

Therefore, the necessary scientific and disciplinary expertise while aiming to diversify the groups should be used wherever possible.

Some of the features to be considered when allocating experts to proposals are:
- Clarity of the roles, responsibilities and expectations including timing of events and deliverables;
- Effectiveness of communications in the above. This may include an electronic or paper copy of signatures, confirmation, agreements or acknowledgments;
- Effective and timely identification and, when appropriate, resolution of conflicts of interest as described in the previous sections. In cases of deviations from the advertised rules and procedures, it is essential to keep a record of how the conflicting situation was resolved. This should include clear statements from the reviewer in question stating that he/she does not feel that his/her judgment is biased in any way as a result of the apparent conflict identified;
- Confidentiality (single- or double-blind). Members of panels and committees who may have access to confidential information (both content of proposals and identity of proposers) should sign a confidentiality agreement (either electronically or through paper copies). As mentioned in §3.2.2, in some countries national legislation may call for complete transparency of the process including identities of applicants and reviewers;
- Reviewers must be instructed to inform the programme officer if they feel their expertise is not relevant or adequate for conducting the required assessment.

30. European Science Foundation (2009), Research Careers in Europe – Landscape and Horizons, Page 4.

4.5 Reader System

In order to overcome some of the inherent variability and inconsistency of the conventional approaches of peer review the so-called 'Reader System'[31] has been proposed as an alternative method. A potential problem with the conventional methods is the "measurement error due to the idiosyncratic responses when large numbers of different assessors each evaluate only a single or very few proposals". In the proposed reader system approach, a small number of expert readers are chosen for each sub-discipline. The same readers review all the proposals in their remit. They will then prioritise or rank all the proposals they have read. However, the results of the survey on peer review practices show that the reader system procedure is only rarely applied, at least for the three most common funding instruments: *Individual Research Programmes*, *Career Development Programmes* and *International Collaborative Research Programmes*[32].

4.6 The use of incentives

Participating in peer review and evaluation exercises in varying capacities is now considered as a necessary ingredient of the activities of scientists and researchers throughout their careers. Those who publish and who submit research proposals create demands for peer review. They must therefore be prepared to contribute their share of peer review in order to maintain the levels of self-organisation required for the selection of the best science to receive public funds through peer review and evaluation.

Items listed below are pertinent to the use of incentives:

- The aforementioned self-organisation expected of the peer review system is under stress, perhaps because of increased demands;
- Some organisations pay their reviewers (both external and panel) to conduct assessments while others do not;
- Although monetary incentives tend to increase the chances of acceptance by the targeted reviewers, it is not clear whether or not it will increase the quality of assessments;
- It is recommended to use monetary incentives only when really necessary;
- It is recommended to consider other types of incentives either to the reviewers directly or to their institutes. Some organisations pay the institutes of their reviewers for every review completed;
- Incentives should have a motivational impact as they are meant to be a token of acknowledgment and appreciation. They should not contribute to creating additional adverse side-effects and expectations such as a race to pay more for better reviewers; compromise of quality for quantity; giving rise to an exaggerated commercial value for peer reviewing which is inherently an intellectual and scientific endeavour regarded as normal professional contributions in each field.

4.7 Expert assessments

Once the experts have been selected, invited and confirmed as reviewers, and proposals are assigned to them, the actual process of assessment will begin.

There are substantial differences between the roles of the individual/remote reviewers and the panel members when conducting their assessment or evaluation tasks (Figure 8).

4.7.1 Briefing

Before the tasks of both individual/remote reviewers and panel members begin, it is essential that their assignments are clearly described and communicated. This is normally done through briefing sessions (possibly using video or teleconferences), orientation sessions, emails and documentation including manuals, protocols, recommendations and instructions.

The information provided should, as a minimum, cover the scope and objectives of the call, the process of peer review, evaluation criteria and the timeline to be followed. Other relevant information that could be communicated to the reviewers may contain explicit instructions and guidance on the use of bibliometric indices, and on providing equal playing fields through promotion of gender balance and recognition of individual non-standard career paths (See §4.4.3).

During remote evaluations and until the assessments are submitted, the channel for information exchange should be kept open to respond to questions that may arise.

4.7.2 Evaluation criteria

At this stage it is assumed that a clear set of evaluation criteria specific to the funding instrument at hand has been determined and included in the

31. See Jayasinghe, Marsch and Bond (2006).
32. See European Science Foundation (2010b), *ESF Survey Analysis Report on Peer Review Practices*, in particular Section 4.2, Question 102: "Do you proceed according to the 'reader system' when organising the review for this instrument?" (Table 4.5).

Figure 8. Expert assessments

promotional material and in the call for proposals. These criteria must be sharp, clear and concise. They should be formulated such that the key aspects of the proposals can be measured in relation to the main scope and objectives of the programme. The assessment criteria should not attempt to be exhaustive and include criteria that will not be strongly relevant and determining in the decision making process for the given instrument.

The criteria must be clearly drafted and easily applicable. All attempts must be made to minimise room for diverging interpretations of the criteria and for ambiguity. Evaluation criteria in the most general sense may be grouped into four categories as described below. It should be noted that, depending on the funding instrument and the variants under consideration, different combinations of these main groups of criteria may be applicable[33].

I. Relevance and expected impacts (driven by programme policy, strategy, mandates, etc.)

- Relevance of the proposed work to the scope of the call;
- Broader impact (scientific, knowledge creation, socio-economic, etc.);
- Incremental versus transformative gains;
- Associated risks;
- Requested resources:
  - budget: although it may be inevitable for some organisations to actually scrutinise the overall amounts requested by the proposers, it is more appropriate to avoid this and instead to assess the appropriateness of the cost items mentioned below that can be used as a measure of confirming the requested budget,
  - staff effort,
  - access to infrastructure,
  - equipment and consumables,
  - travel,
  - networking and dissemination;
- Ethical issues: compliance with standard norms and ethical practices when dealing with safety and security, use of animals and human subjects, environment, embargos and sanctions;
- Gender balance: some organisations pay specific attention to promote gender balance within their national programmes.

II. Scientific quality

- Scientific/intellectual merits of the proposed research: clear, convincing and compelling;
- Thoroughness: definition of the problem and proposed solutions, review of state of the art;
- Novelty and originality:
  - unconventional,
  - potential for the creation of new knowledge, exciting new ideas and approaches,
  - use of novel technologies/methodologies,
  - innovative application of existing methodologies/technologies in new areas,
  - potential for the creation of new fundamental questions and new directions for research,
  - feasibility: scientific, technological, access to infrastructure, recruitment, project timeline, management plan and deliverables, associated risks,
  - appropriateness of the research methods, infrastructures, equipment and fieldwork.

III. Applicant

- Academic qualifications and achievements in relation to their stage of career;
- Research experience and level of independence;
- Demonstrated expertise of the applicant(s) in similar projects;
- Applicants' scientific networks and ability to successfully disseminate research findings, *i.e.*, knowledge transfer activities;
- Appropriateness of the team of applicants in terms

33. Part II of this Guide will provide more detail on criteria for each instrument.

of availability and complementarities of all the relevant expertise and synergies;
- Publication track record. It is suggested to require the applicants to report only on a selected number of their most relevant and important articles (5 to 10 maximum) instead of providing long lists;
- Bibliometric indices: As mentioned in §4.4.3, for the use of bibliometric indices, reviewers should be explicitly advised to apply these with care and only as a complementary tool and not as a sole determining factor without taking into consideration a variety of other factors that can influence publication patterns and scientific standing of the applicant (see footnote 29 on page 25).
- When assessing scientific standing and qualification of the applicants, conscious attention should be paid to individual career paths and circumstances caused by career interruptions and changes, *e.g.* due to family reasons or inter-sectoral and non-academic mobility such as working for industry (See footnote 30).

IV. Research environment
- Availability and accessibility of personnel, facilities and infrastructures;
- Suitability of the environment to conduct the proposed research;
- Availability of other necessary resources;
- Mobility and career development aspects.

4.7.3 Scoring

In order to synthesise and compare assessments of proposals under evaluation, it can be very beneficial to assign a scoring scheme to each of the adopted criteria. Most evaluation criteria used for assessment come with a set of multiple choices for the reviewer to select from. These are normally comparative statements that carry a numeric or alphabetic score. The resolution of the scoring system for individual criterion may vary according to the particular circumstances of the call and assessment criteria but, generally speaking, a scale of four or five statements with determining scores or points may be used. For example: A. for Excellent; B. for Very Good; C. for Good; and D. for Poor. It should be noted that adopting an odd number of choices for a criterion may lead to implicitly created biases towards the middle.

Different weighting factors may be applied to the different criteria with a differing degree of importance. However, it is advisable to keep such a system as simple as possible. It is also common to calculate the average of all the scores or to provide a single overall score for the purpose of comparison and ranking. A threshold could be set as a cut-off line for the overall scores or for the scores on a given criterion in order to determine fundable versus non-fundable proposals.

The relative position of the cut-off line on the full spectrum of scores will have to be determined by the funding organisation in charge of the programme and based on the size of the available budget. Experts are asked to provide a score for each criterion, substantiated by written comments. The comments should justify and be in line with the given score. Reviewers' comments should be checked to ensure usability, legibility and tone of language before they are used for further steps.

There are different sets for scoring the main assessment criteria described above that can be adopted, each with slight advantages and disadvantages. In Table 3 an example of a five-point scoring system is provided.

For example, when measuring the scientific quality of a proposal, the following definitions can be used[34]:

Poor: "The criterion is addressed in an inadequate manner, or there are serious inherent weaknesses."
Fair: "While the proposal broadly addresses the criterion, there are significant weaknesses."
Good: "The proposal addresses the criterion well, although improvements would be necessary."
Very Good: "The proposal addresses the criterion very well, although certain improvements are still possible."
Excellent: "The proposal successfully addresses all relevant aspects of the criterion in question. Any shortcomings are minor."

Evidently, different organisations may use other schemes based on their particular requirements and existing practices. According to the specific nature of the funding schemes and the call, it may also be decided to assign differing weights to some or all of the criteria.

Budget

When assessing the requested budget for typical programmes the following scoring scheme may be used:

4 (or A): Highly appropriate
3 (or B): Appropriate
2 (or C): Marginally appropriate
1 (or D): Inappropriate.

34. See European Commission (2008), *Rules for submission of proposals, and the related evaluation, selection and award procedures,* in particular Section 3.6, p. 14.

Applicant	Relevance and impact of the proposed research	Scientific quality of the proposal	Numeric score	Alphabetic score
Outstanding	Highly significant	Excellent	5	A
Very good	Significant	Very good	4	B
Good	Average	Good	3	C
Sufficient	Low	Fair	2	D
Poor	Insignificant	Poor	1	E

Table 3. Five-interval scoring scheme

4.7.4 Right to reply

In contrast with redress or appeal that can be invoked to contest the final decision of the selection process, the 'right to reply' is intended as an integral part of the peer review process itself. It is normally applied to two-stage peer review systems where a panel of experts will make a selection, prioritisation or ranking of proposals based on external referee assessments. Before the panel members see the external assessments, the applicants are provided with the opportunity to study the assessments of the external referees and to comment on the arguments and evaluations of the referees. Written feedback statements are invited within a short period of time, normally in about one week. Applicants should be aware of this step of the process and its timing through advance notice and possibly reminders.

As noted in §Applicants' rights to intervene this step is not provided to amend or elaborate the initially submitted proposals or to change them in any way. It is only meant to allow the applicants to comment on factual errors or misunderstandings that may have been made by the referees while assessing the proposal. In addition to the applicants, the external referees and the members of the review panel should also be made fully aware of the procedures and timing related to the rebuttal stage.

Results obtained from the survey on peer review practices indicate that only 46% of the responding organisations give their applicants the right to reply during the peer review process. This includes 13% that do this across all funding instruments and 33% applying it only to some of their instruments. The procedure is considered "too time consuming" by 50% of the respondents and "too costly" by 6% of these.

The majority of the responding organisations have confirmed the very high importance and added value of the right to reply as a component of the review process[35]. For those organisations that include the right to reply, the main consequences resulting from the applicants' replies are stated to be very significant. Specifically, 64.3% have indicated, as a consequence of the applicants' replies, consideration of the feedback in the further review and selection process, for 50% the consequence has been stated as consideration of the feedback at the stage of funding decision and for 28% the consequence is stated as a modification of the reviewers' statements[36].

RECOMMENDATION

Incorporate the 'right to reply' in the process of peer review whenever possible. This step brings significant reliability and robustness to the decision making process and will increase the overall quality and equitability of the peer review.

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35. However, other studies have concluded that the peer review process without the right to reply is fast and cost effective, for example see the FWF Discussion Paper by Fischer and Reckling (2010), p. 6.

36. See European Science Foundation (2010b), *ESF Survey Analysis Report on Peer Review Practices*, in particular Section 3.8, Question 55: "Does your organisation allow applicants to reply to the assessment of their proposals during the peer review process and before the final funding decision is made? and Question 57: "Which consequences might the applicant's replies have?" (respectively Tables 3.35 and 3.36).

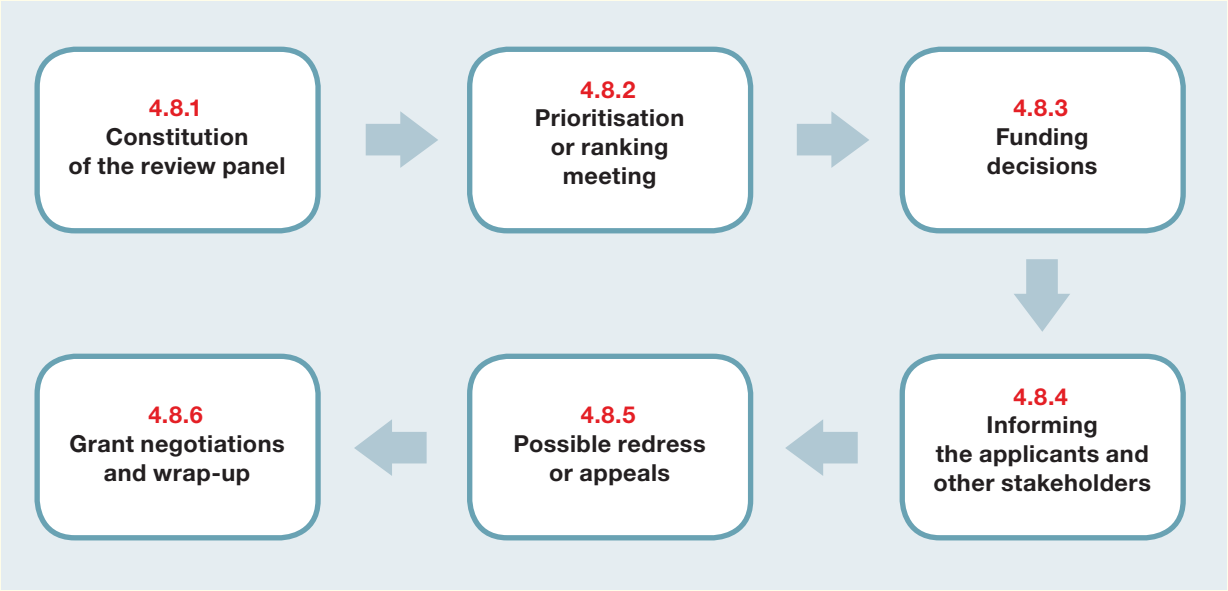


Figure 9. Final decision

4.8 Final decision

The final stage of a generic peer review system typically consists of the steps that are described in this section and illustrated in Figure 9. For specific funding instruments, some of the building blocks suggested here may not apply to all funding instruments as further elaborated in Part II. In a general sense this last stage consists of the prioritisation or ranking of proposals which leads to the final decisions on the funding of selected applications as briefly outlined below.

4.8.1 Constitution of the review panel

It is assumed that some of the preliminary work in identifying the membership of the review panel starts at the preparatory stage. At this stage, the panel needs to be fully constituted with a sufficient number of experts required to cover the depth and breadth of the expertise needed. In some programmes, the panel may be created per call and according to the disciplines concerned, and in some other cases the panel may be a standing or a dedicated committee.

Once the panel has been assembled, the following two items should be considered:

I. Terms of reference, or terms of participation for the panel members

- Conflict of interest and confidentiality agreements.

II. Mandate of the panel members (some of the items below may not apply to all instruments)

- Review and appraisal of external (remote) assessments;
- Prioritisation (*e.g.*, for responsive mode) and/or ranking of proposals;
- Recommendations on funding threshold;
- Recommendations on the appropriateness of the requested resources, equipment and infrastructure;
- Preparation of the pre-meeting assessment reports and evaluation summaries;
- Preparation of the consensus reports summarising the decisions and feedback to applicants;
- Approval of the minutes of meetings.

4.8.2 Prioritisation or ranking meeting

The ranking or prioritisation meetings are the most decisive steps in peer review for both the one-stage and the two-stage selection schemes.

Normally, while the review panel is being constituted preparatory work for the scheduling and convening of the meeting should start. For one-stage selection schemes the panel will make the final selection of the proposals based on their own expert assessments of the competing proposals. For two-stage schemes, the panel relies on expert assessment by individual/remote reviewers who may or may not be part of the panel. The review panels are in these situations responsible for arriving at consensus decisions on the competitive merits of the proposals using external assessments and possibly the replies from the applicants to the remote/indi-

vidual assessments. The funding decisions should normally follow and be according to the ranking and prioritisation suggested by the review panels.

Some of the aspects to be considered are listed below:

I. Effective planning and running of the meeting

- Sufficiently long advance notice and schedules;
- Provision of reliable IT tools and resources such that panel members can access the proposals, remote assessments and applicants' replies online and ideally be able to provide their pre-meeting comments and evaluations also online. In this way, supporting documentation for the meeting can be generated very efficiently;
- Agenda for the meeting allocating enough time for the different parts of the meeting;
- Provision of all background and supporting documents – it is recommended to use electronic files wherever possible and not to print files if not really necessary;
- Description of the required deliverables from the meeting and from the members;
- Ensure the meeting is of sufficient length such that the panel is able to discuss all proposals with the required levels of attention and is able to conduct the ranking/prioritisation and draft their consensus report(s);
- Ensure an experienced science officer and possibly an administrator are assigned and available to provide secretariat support to the meeting.

II. Assigning an authoritative Chair for the panel

- It is very important that the Chairs understand clearly what is expected of the meeting;
- Briefing notes particularly prepared for the Chairs with clear instructions, rules of procedure and list of deliverables need to be communicated to the Chairs in advance.

III. Assigning rapporteurs and/or designated reviewers to all proposals

- Normally two or three rapporteurs or reviewers should be designated for each proposal;
- The profile of the rapporteurs should collectively cover all disciplinary perspectives that are needed;
- Ensure uniformity and consistency of attention to all proposals (number of rapporteurs, coverage of the scope, etc.);
- Normally (especially for two-stage peer review systems) the members of the panel are not asked to assess their assigned proposals using the same criteria used by the individual/remote reviewers; rather they are asked to appraise and make sense of the proposal in relation to the remote assessments and, if available, to the applicants' replies to the remote assessments;
- Avoid assigning an excessively high number of proposals to each member. The appropriate limit could vary substantially in proportion to the size of the programme and the length of the proposals.

IV. Running the meeting (rules of procedure)

- Declaring and recording conflicts of interest, how they were dealt with and any major objections to decisions of the panel;
- Ensure active, all-inclusive and rich participation;
- Ensure clear understanding on the mode of collective decision making and approval by the panel: to decide between unanimous agreement versus consensus driven by majority; how to deal with major objections to final decisions; the weight and priority of the views of rapporteurs on their proposal versus the views of the other members of the panel, versus the potential intervention of the Chairs;
- In the case of having more than one or two rapporteurs, it is advisable to assign a 'lead rapporteur' with the mandate of starting the discussion on a given proposal by first providing a brief summary of the work proposed followed by their appraisal of the remote assessments and the applicants' reply;
- Conduct the prioritisation or ranking in at least two rounds. During the first round, divide the proposals into three priority bins of high (to be funded), medium (may be funded) and low (not to be funded). In consecutive second or possibly third rounds, the relative position of the proposals in and across the three groups will be further refined and a final prioritised or rank-ordered list will be determined;
- The panel should approve the final rank-ordered list.

V. Consensus reports[37]

- Consensus reports are prepared by the rapporteurs and approved by the panel. These reports contain statements on behalf of the panel that can be forwarded to the applicant describing the final

37. Disagreement is an integral part of scientific discussion and science develops through a dialectic confrontation and dialogue. Therefore, although the process of achieving consensus among reviewers can sometimes appear as a formidable task, it should be followed consistently and persistently and in accordance with the agreed terms of reference for the deliberating group.

decisions. Consensus reports should not replace the minutes of the meeting but rather be attached to the final approved minutes. Consensus reports should strongly reflect the relative position of the proposals on the rank-ordered or prioritised list;
- The comments provided by the rapporteurs should be of high scientific quality, be objective and to the point. They should be descriptive of the final decision of the panel on the proposal, especially if that decision is not in line with the overall views of the remote assessors;
- As far as possible, ensure that the consensus reports are written and approved before the meeting is adjourned;
- The minutes of the meeting are prepared after the meeting by the assigned science officer/administrator and must be approved by the panel before being released. The minutes will also include the final prioritised or rank-ordered list, as well as the consensus statements and intermediate changes, conflicts of interests, etc.

4.8.3 Funding decisions

Normally the final funding decision is made for the funding organisation by a dedicated committee or board based on the recommendations of the review panel and their suggested rank-ordered or prioritised list.

It is recommended that the rank-ordered or prioritised lists are consistently and thoroughly respected when funding decisions are being made. If the body which makes the final decision on funding is to be given the right to change the order of proposals on the rank lists, despite the recommendations of the review panel, clear criteria and justifications for such changes should be described in advance and recorded as the cases present themselves.

Most funding organisations negotiate the amount of the requested grants with the applicants, while some organisations provide the grants as requested without any changes.

RECOMMENDATIONS

- The rank-ordered or prioritised list must be consistently and thoroughly respected when funding decisions are made.
- The feedback from the review panel on the appropriateness of the requested budgets should be used if funding negotiations are to be included.
- • • •

4.8.4 Informing the applicants and other stakeholders

Applicants should be informed of the outcome of the review panel and be given access to the consensus reports on their proposal as soon as possible.

Whether or not the ranking position of a proposal is given to the applicants differs across funding organisations; this feature is therefore to be decided by each organisation. It is recommended that if the ranking positions are not to be disseminated, necessary efforts are made to keep the list confidential and to prevent the information from leaking. If, however, the decision is made to release ranking positions, it is advisable that the rank order of any one proposal is only provided to the applicants of that proposal.

4.8.5 Possible redress or appeals

Applicants should be given the chance of appealing or contesting the final decision on their proposal. A clear description of the procedure and potential outcomes should be prepared and disseminated to all applicants when they submit their application.

Redress is important when there has been a substantial procedural error in the adjudication process leading to results unfavourable to the application, for example, when there are major deviations from the policy regarding conflict of interest, compromises in quality and integrity of the process, and any other clear wrongdoing. It is important that the redress process is transparent and fast.

Appeals with a favourable outcome towards the applicants must lead to at least one of the following two remedies:
- Fresh peer review;
- Revoking of the first decision resulting from the peer review process in favour of the application.

4.8.6 Grant negotiations and wrap-up

As previously mentioned, before the grants are awarded there may be a period of grant negotiation between the funding organisation and the applicants. Depending on the nature and size of the grants being awarded, and on the national regulations and standard practices, the scope and intensity of the negotiation can vary substantially. In some organisations, the grants requested are awarded fully with no changes across all funding instruments, whilst in some organisations, and depending on the size of the programmes, the final amounts granted could be quite different from the requested budgets.
- As briefly noted in previous sections, sometimes the peer or expert reviewers are asked to provide comments on the appropriateness of the requested resources as part of their assessments,

e.g., commenting on the number of researchers and graduate students to be employed, procurement of major equipment and access to infrastructure. This information can be used by the funding organisation as part of their final decision and during their negotiations with the applicants.

- Make conscious and clear decisions at the outset during the preparatory phase on whether or not the funding organisation will scrutinise and possibly make changes to the requested budgets. If such changes are part of the process, the eligibility of all cost items needs to be specified in the call, including possible limits or other conditions that may apply to individual items or the overall requested amounts.

RECOMMENDATIONS

- Discretionary and *ad hoc* adjustments of the requested budgets by members of staff at the funding organisations should be avoided as much as possible.
- If negotiations and changes are to be included as part of the process, the expert assessors' views must be used as much as possible as the basis for refining the funding allocations. Organisations' dedicated scientific boards, councils and committees could also provide input as appropriate.
- • • •

As part of the negotiations and grant agreements, the following elements could also be considered:

- Clarification of the Intellectual Property Rights (IPR) directly generated under the contract, depending on the nature of the research being funded (*e.g.*, commercialisation potential and value);
- Care must be given as the details and stringency of the agreements defining the ownership of the IPR by various parties involved (researchers, research institutes and the funders) may be applied differently. This becomes more critical when programmes are multinational or multi-agency;
- IPR may (depending on the nature of the research) include and delineate both the Foreground and the Background Intellectual Properties;
- Engage (when necessary) the parties in *licensing* or *commercialisation agreements* on the generated Intellectual Properties;
- Reporting requirements: frequency, scope, format, etc.;
- Adherence to any other national, European or international directives, regulations or good practices in research;
- Ex-post evaluation requirements: nature, frequency, format, required self-evaluation reports, etc.

4.9 Communication

Communication is a crucial element required across the entire process of peer review described in the previous sections. In order to safeguard the integrity of the process, it is necessary that all the implicated parties in the process are clearly informed of the process, procedures and decisions.

- Communication should occur in a timely fashion.
- Communication should be effective in delivering the right message to the correct recipients.
- Communication should be efficient (both concise and clear).

4.9.1 Communication to applicants

During the peer review process communication with the applicants is of crucial importance. Effective and timely feedback to the applicants determines to a large extent the level of transparency of the process. Some of the items needing attention are listed below:

- Acknowledgment of receipt of proposal – immediately after submission;
- If required, intermediate communication to the applicants informing them of possible incompleteness of their application or lack of successful submission (especially when this is due to technical issues such as IT tools and resources);
- Communication for further information (if applicable);
- Communication on eligibility requirements and status (if applicable);
- Communication on the right to reply (if applicable);
- Communication on the decision of the review panel;
- Communication on the final decision;
- Communication on redress applications and their outcome (if applicable).

4.9.2 Communication to experts

The individual/remote reviewers, as well as the members of the review panels and any other committees or boards that may be involved in making decisions, should be informed of all the main elements and steps of the programme they take part in as well as the detailed description of their assignment, roles and responsibilities. The following items should be considered:

- Maintain the right balance between providing necessary and useful information without overdoing it;
- Divide the information to be communicated into two groups:

1. Minimum necessary information: This comprises the information that the experts need in order to easily understand the nature of their assignment, *i.e.*, roles, responsibilities, main deadlines and required deliverables. Some level of description of the peer review and selection process directly relevant to the experts is necessary (*e.g.*, on whether there is a rebuttal in the process, double-blind versus single-blind versus fully transparent assessments). The minimum necessary information should be communicated to all reviewers explicitly through official emails or letters, clearly and in good time;
2. Complementary and good-to-have information: This may include background information about the programme, the overall peer review process, statistics, etc. The complementary information should be easily accessible to the reviewers in case there is the interest. This information could be included as an annex to letters or emails or on dedicated websites.

4.9.3 Communication to commissioning parties (*e.g.*, funders)

This item becomes relevant in cases where the implementing body is not the same as the commissioning organisation, for example, for multi-organisational collaborations where there may be a coordinating or implementing organisation different from the participating funding organisations. In these cases, the requirements for communication protocols and reporting should be made clear at the outset and should be included in the multilateral agreements defining the collaboration. Some of the items that will be necessary to consider are:

- Effective and timely communication to responsible Management Committees (a body representing all participating organisations and charged with decision making responsibilities on their behalf);
- Details of the entire process from the preparatory to the final phases, should be communicated to the commissioning parties, including:
  - opening and closing of the call,
  - number and nature of proposals received,
  - dates and agenda of meetings,
  - remote assessments,
  - replies from the applicants to the remote assessments (rebuttal comments),
  - review panel deliberations,
  - minutes of meetings,
  - rank-ordered or prioritised list of proposals, etc.

4.10 Quality assurance

Section 3.3 of this Guide provides a brief review of quality assurance as one of the supporting pillars of good practice in peer review. In this section, more practical and elaborated approaches and methodologies are outlined for assuring the quality of the processes and the results through careful monitoring and evaluation.

4.10.1 Standard practices for assessment of quality

It is recommended that the following elements be considered:

- Guidance and coaching of staff members;
- Instructions and training for external reviewers to ensure coherence and consistency;
- Provision of briefing notes and instructions to members of review panels;
- Configuration control (tracking of documents and their changes).

4.10.2 Quality of reviewers

The scientific or research profile and competencies of the remote/individual reviewers as well as of the members of review panels play the most important role in achieving effective, equitable and efficient selection. Therefore incorporating explicit measures to monitor the quality of these individuals in relation to their specific mandate and assignment will be most advantageous.

It is noted that, depending on the nature of the programmes at hand, different profiles may be considered for remote reviewers versus members of ranking or review panels (see §4.4.3).

For example, members of the panels are normally expected to be more established/senior academics or researchers with similar broad experiences in the past, while the remote or individual reviewers could be very much early career experts with in-depth scientific knowledge.

Validated and proven advanced information technology and automation can play a role in establishing the means of:

- characterising the research profile and performance of different individuals within the organisation's databases;
- carrying out a reliable search for reviewers in the database while automatically matching scientific scope of proposals to the required reviewer profiles and expertise.

4.10.3 Measure of quality and usability of the reviewers' assessments

Some of the items defining the quality and usability of the assessments made by individual/remote reviewers are:

- Conflicts of interest;
- Completeness;
- Comprehensibility and clarity;
- Appropriateness of the language used;
- Fit for purpose;
- Timely;
- Substantiated judgments and scores.

4.10.4 Evaluation

Evaluation entails appropriate measures and means of supervising and scrutinising the process and its implementation by authoritative and experienced individuals or groups of individuals. This could comprise parties either internal or external to the organisation or a mixture of the two. The term 'evaluation' used here does not refer to ex-post evaluation of the funded research[38].

It is important to clearly describe to all relevant parties and at the beginning of the process the following items:

- The purpose of the evaluation;
- The scope of the evaluation;
- The means available to conduct the evaluation;
- What could be the outcome of the evaluation.

4.10.5 Overall recommended measures in support of quality assurance

To support quality assurance the following aspects may be considered:

- Identify and mandate dedicated individuals or groups of individuals responsible for the conceptualisation and administration of quality reviews; as far as possible, ensure continuity by avoiding the use of temporary assignments and frequent staff changes. Make clear the roles and the responsibilities of the programme officers and administrators and thus demand accountability;
- Ensure consistency and clarity of the published material and all other communication streams to all stakeholders;
- Offer clear instructions, briefing notes and, if possible, training sessions for reviewers and panel members to ensure the coherence and consistency of their approaches;
- Keep the procedure as simple as possible, increase the level of standardisation and automation whenever proven technologies and resources are available. Systematic tracking of reviewers' quality can be very beneficial.
- Conduct periodic reviews of the processes and procedures. The cycle length of the reviews – whether they are programme-based, department/unit-based or institution-based – may vary according to disciplinary or institutional needs.

The survey on peer review practices has shown that the responding organisations adopt the following correcting actions in cases when the quality and usability of the assessments fall short of their standards:

- The entire review may be discarded and not used according to 56% of the respondents;
- The review might be returned to the reviewer for completion/additional information (according to 52% of the respondents) or for modification (according to 32%);
- 40% of the responding organisations indicated that reviewers may be tagged based on the quality and usability of their assessments[39] with qualifying information that may be used for future references;
- The data protection laws of each country may dictate the nature and usage of this information.

4.11 Variants of funding instruments and their implication for Peer Review

One of the main challenges for structuring both the Guide and the supporting peer review survey has been to categorise main funding instruments common to European research funding and performing organisations and councils. The conclusion has been to treat the task of grouping of instruments along two dimensions.

The first dimension considers the main typology of the funding instruments that is driven only by the nature and size of the funding opportunity; the second dimension relates to the different program-

38. Ex-post evaluation of the funded research has not been included as part of this Guide. On this topic see, for example, the Reports of the ESF Member Organisation Forum on Evaluation of Publicly Funded Research at: http://www.esf.org/activities/mo-fora/evaluation-of-publicly-funded-research.html and the ESF Member Organisation Forum on Evaluation of Funding Schemes and Research Programmes at: http://www.esf.org/activities/mo-fora/completed-mo-fora/evaluation-of-funding-schemes-and-research-programmes.html

39. See European Science Foundation (2010b), *ESF Survey Analysis Report on Peer Review Practices*, in particular Section 3.2, §3.2.2, Question 22: "What concrete actions can result from the evaluation of a review's quality and usability by your organisation?" (Table 3.7).

Key distinguishing features	Peer review implications	
	Solicited mode	Non-solicited (responsive) mode
Peer review format	One-stage or two-stage submission of proposals; one-stage assessment by individual/remote reviewers; or two-stage assessment by remote reviewers followed by a panel ranking	A one-stage submission of proposals; plus two-stage assessment by individual/remote reviewers followed by prioritisation done by a review panel
Preparatory phase	In addition to defining the scientific scope and objectives of the call, clear definition of the timeline for opening and closing of the call and for the ensuing peer review stages	Changes to the scope and objectives of the calls and to the procedures occur as the needs arise throughout the year
Processing of proposals	Different stages of peer review occur at fixed intervals	Proposals are checked for eligibility and then retained until a desired number is accumulated before passing them through the peer review stages
Selection of experts	More work can be done upfront as the expected nature of proposals is predetermined	Normally from a dedicated database of reviewers who are familiar with the process and the various funding streams covered by responsive mode in the organisation

Table 4. Solicited versus non-solicited calls: peer review implications

matic variations of the given instruments. This is referred to as variants of the funding instruments, for example 'solicited versus non-solicited or responsive' are considered as variants that can be applied to any of the funding instruments.

Section 2.2 of this Guide briefly describes the main categories included and the potential variants of these. In the present section, the main variants are revisited with the aim of elaborating on any specific peer review implications that they may require.

4.11.1 Solicited versus non-solicited or responsive mode

As mentioned in §2.2.1, responsive-mode calls for proposals are continuously open and applications can be submitted at any time. When reaching a desired number, applications are grouped and processed through the peer review stages of remote assessment plus a prioritising panel. This is in contrast with solicited-mode programmes in which clearly defined timelines identify the opening and closing of the call for proposals and therefore the ensuing peer review stages.

4.11.2 Thematic versus non-thematic

Although the implications of these variants of funding instruments are not substantial with regard to the peer review process, the evaluation of the applications should, however, address the thematic or non-thematic coverage of the research proposals. Non-thematic calls have an open scope within a certain defined domain or discipline or groups of domains or disciplines. On the other hand, thematic or topical programmes are meant to focus research efforts on given themes or subjects in and/or across domains.

According to the results of the survey on peer review practices, from 190 programmes reported across all instruments 103 have been identified as being Thematic/Topical[40].

In terms of specificity of peer review the following items should be considered when dealing with thematic calls:

- Clarity on the definition of the scope:
  - themes, topics, subtopics;
- Means of selecting themes or topics:
  - investigator-driven 'grass-root', 'bottom-up' versus policy, strategy driven at organisational level 'top-down';
- Eligibility criteria:
  - covering a minimum number of topics or subtopics within the theme,
  - including minimum number of investigators representing the topics;

40. See European Science Foundation (2010b), *ESF Survey Analysis Report on Peer Review Practices*. Annex A: *Survey*, Question 2: "Please indicate the scientific scope of the instrument".

- Assessment criteria:
  - Relevance to the thematic/topical scope,
  - Potential impact in and across various subtopics of a theme,
  - Synergy between different elements covering interrelating or complementary research topics within a theme,
  - Coherence and degree of integration of different elements within the proposals.

4.12 Peer Review of monodisciplinary versus pluridisciplinary research [41]

The history, science and politics of 'pluridisciplinary' (often referred to as 'multidisciplinary', or 'interdisciplinary') research have been the subject of academic debates and inquiry. In addition to these two generic terminologies that have sometimes been used interchangeably, other delineations and refinements of 'pluridisciplinary research' have been suggested (see §2.2.3 of this Guide).

The need for academic attention and precision in characterising and defining various types of pluridisciplinary research has been driven by the fact that pioneering scientific discovery and scholarly achievements have increasingly occurred at the intersections of, or through the involvement of collaborators from, more than one traditional discipline or field of study. Despite these developments, implications of the disciplinary character of research topics on defining optimal peer review processes have not received equal attention within the interested scientific communities.

A comprehensive analysis of the literature focusing – in parallel – on 'performance' and 'evaluation' is provided in Klein (2008). While recognising the inherent heterogeneity of the different types of pluridisciplinary research, this review article presents seven *generic principles* each with several *key insights* that are aimed at creating a coherent framework for addressing evaluation. These are: (1) variability of goals; (2) variability of criteria and indicators; (3) leveraging of integration; (4) interaction of social and cognitive factors in collaboration; (5) management, leadership and coaching; (6) iteration in a comprehensive and transparent system; and (7) effectiveness and impact[42]. This article also suggests that it is becoming increasingly important to critically examine the unquestioned assumptions about three underlying concepts of *discipline*, *peer* and *measurement* in the context of pluridisciplinary evaluation.

Defining effective and fit-for-purpose approaches of peer review applicable to multi-, inter-, cross- and trans-disciplinary (MICT) proposals is the subject of this section. Despite some apparent misalignments of scholarly and disciplinary outlooks on pluridisciplinary research (for example, going across the health sciences, to engineering, to arts and humanities), it is hoped that the scheme proposed in this section will create a baseline point of reference including a set of general recommendations for dealing with these variants in a consistent manner. Indeed, if the idea is to promote research collaboration across geographical and disciplinary borders, a common point of reference would be of real value in reconciling or at least in contextualising the different perspectives.

In these approaches the standard peer review models described in previous sections must be sharpened and calibrated, while the interactions among the different disciplinary approaches and perspectives are carefully considered. Before further details can be provided on the format or requirement of the various peer review processes suitable to each type, it is necessary to revisit commonly adopted definitions in order to explore both shared and distinctive features of these groups so that a minimum number of peer review procedures can be conceived. That is, to define how many different peer review methods should be implemented in order to cover the full spectrum as defined by the four categories when dealing with selection and funding of pluridisciplinary research proposals.

Table 5 illustrates the interaction of disciplines that give rise to MICT-type research topics[43]. The boundaries separating some of the four categories from each other may be subject to interpretation when it comes to applying this scheme to real examples. Hence some of the examples provided in the table may be categorised differently.

For the purpose of calibrating an appropriate peer review process for MICT proposals, it will be useful to consider the following three preliminary key criteria/questions and adapt the procedures accordingly:

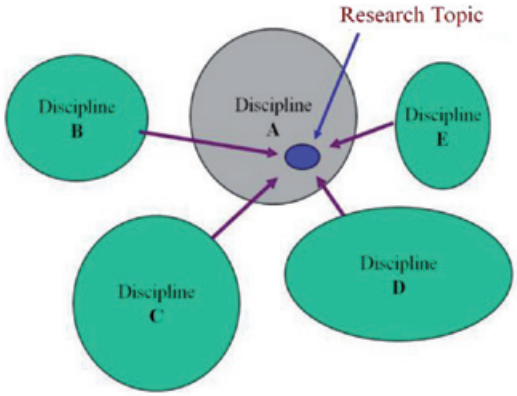
41. For the purpose of this Guide a 'discipline' underlying a given research topic is considered to be a domain of research activity as delineated within the Research Classification Systems used by the organisation conducting the peer review. It is further understood that the research topic in question falls entirely or significantly within the scientific remit of the organisation.

42. See Klein (2008), pp. 117 -118.

43. Definitions and corresponding diagrams used in this table are based on Vanegas (2009).

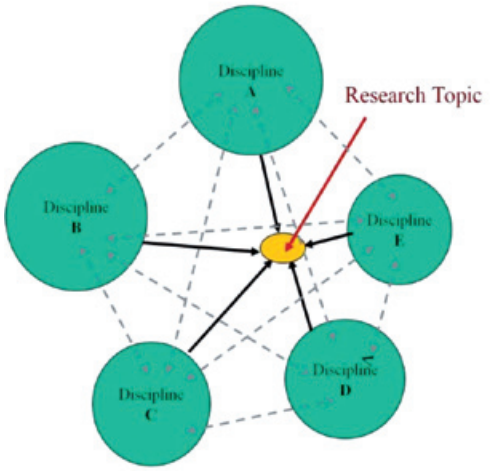
Multidisciplinarity
is concerned with the study of a research topic within one discipline, with support from other disciplines, bringing together multiple dimensions, but always in the service of the driving discipline. Disciplinary elements retain their original identity. It fosters wider knowledge, information and methods.

Examples
Research Topic: Discovery of a particular drug
Host discipline: Pharmacology
Complementing disciplines: Biochemistry, Chemistry, Medicine.



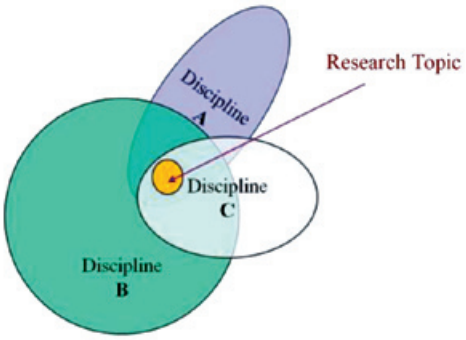
Interdisciplinarity
is concerned with the study of a research topic within multiple disciplines, and with the transfer of methods from one discipline to another. The research topic integrates different disciplinary approaches and methods.

Example
Research Topic: Robotics
Host versus complementing disciplines: this has changed over the years and with the expansion of the field, there could be different host(s) and complementing disciplines from Mechanical, Electrical and Computer engineering, Mathematics, Informatics and Computer Science, Neuroscience or Psychology.



Crossdisciplinarity
is concerned with the study of a research topic at the intersection of multiple disciplines, and with the commonalities among the disciplines involved.

Example
Research Topic: Biologically Inspired Engineering
Host disciplines: Engineering, Material science
Complementing disciplines: Biology, Zoology
Interactions are very strong with commonalities in the way biological systems and engineering counterparts are viewed.



Transdisciplinarity
is concerned at once with what is between, across and beyond all the disciplines with the goal of understanding the present world under an imperative of unity of knowledge.

Examples
Research Topic: Synthetic Biology, Cognition, Artificial Intelligence

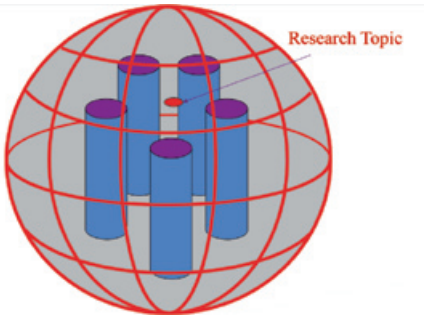


Table 5. MICT definitions and examples

Key Criterion 1:
Whether or not – for the purpose of peer review – the research proposal being considered is genuinely one of the MICT type; is it possible to identify one single discipline that could encompass the whole of the proposed ideas in the proposal and therefore be treated as monodisciplinary? That is, whether the extent of the required interests and engagements from the different disciplines being touched upon by the proposal would really call for an explicitly tailored pluridisciplinary peer review approach or should a 'standard' monodisciplinary approach suffice or even be more appropriate?

Key Criterion 2:
For a proposal recognised to be genuinely of pluridisciplinary character, how and to what extent the various scientific perspectives and judgments from the various disciplines involved should be considered, prioritised and integrated in order to arrive at a fully informed and coherent decision on the merits of the proposed ideas in expanding the disciplinary boundaries and making impact (for example, in creating new knowledge, innovation, new applications, new paradigms, or even new disciplines).

Key Criterion 3:
For a given pluridisciplinary proposal having real and strong links to more than one discipline, is it possible to identify a subset of these disciplines (ideally one) that could be described as *central* to the scope of the proposal with the other disciplines being *complementary, enabling* or *supporting*? That is, is it possible to predict, with an acceptable degree of certainty, that the expected results will touch one (or two) discipline(s) more directly and strongly than the other disciplines implicated?

Addressing these three criteria effectively can pose a challenge to science managers and officers who may not cover the required levels of scientific depth and breadth on all disciplines involved. However, to do justice in valuing MICT-type research it is necessary to provide all the required scientific/expert perspectives and judgments while minimising the risks of unduly penalising the MICT proposals by excessive assessments and inflated scrutiny. It is therefore crucial to consider the above-mentioned criteria even if that means seeking the required expert advice from dedicated or *ad hoc* boards or committees at an earlier stage of the process.

4.12.1 Categorisation of Peer Review Practices

As a first categorisation of the peer review practices suitable for pluridisciplinary research, it is beneficial to divide the funding instruments into two main groups:

1. Instruments that are exclusively designed to fund research that is of MICT type;
2. Instruments that are not exclusively designed to fund MICT-type research but encourage this alongside monodisciplinary proposals.

I. Instruments that are exclusively designed to fund research that is of MICT type

For these instruments, the preparatory phase should include explicit attention to promoting the opportunity, its aims and objectives across the appropriate communities. Information about the specific peer review process should also be disseminated.

As mentioned previously, the first and foremost step in the peer review process that is appropriate to genuinely pluridisciplinary research is the ability to identify the nature and levels of interactions required or expected from the various existing or possibly emerging disciplines. As the first step, proposals should be *screened* by a group of scientific staff with the required level of expertise. The result may be that some proposals are identified as monodisciplinary and are therefore rejected. Those proposals found to be of genuine MICT character will then be *categorised* according to their nature and with the goal of *selecting* one of the scenarios described below in §4.12.2 and the related recommendations on *peer review implementation*.

II. Instruments that are not exclusively designed to fund MICT-type research but encourage it alongside monodisciplinary proposals

For these instruments, although not explicitly designed, it is quite possible that MICT types of proposals are submitted along with monodisciplinary ones. To do justice to these proposals, the process should have the means of identifying them as such and ideally channelling them through the specific and tailored processes as described for Category I above.

Figure 10 summarises the flow of the peer review steps for the two main instruments designed for pluridisciplinary research:

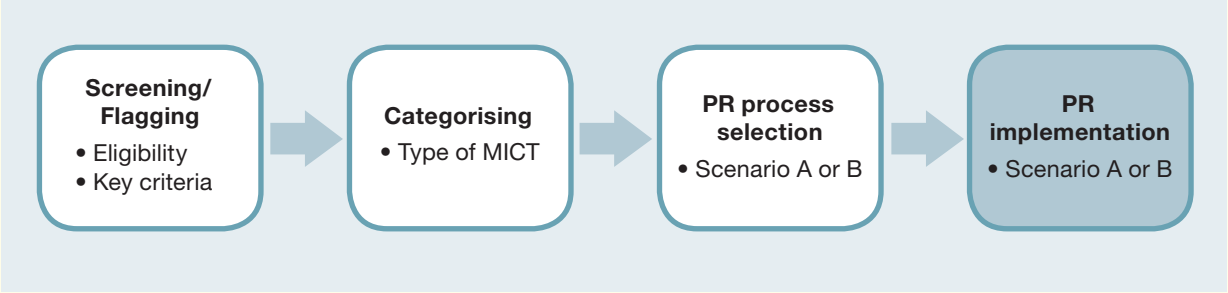


Figure 10. Schematic description of the peer review process for Category I and II

RECOMMENDATIONS

- Whether or not a programme is exclusively designed for pluridisciplinary research, it is recommended to devote the necessary time, expertise and attention at an early stage of filtering or eligibility screening such that proposals that are genuinely of MICT type can be identified and undergo the most appropriate peer review process according to their disciplinary characters.
- For any instrument (whether or not explicitly devoted to pluridisciplinary research), it is recommended to have proposals that are found to be genuinely of MICT character peer reviewed in a two-stage or three-stage evaluation process using individual expert assessments followed by appropriate review panel deliberations and decisions.
- • • •

4.12.2 Peer Review scenarios for pluridisciplinary proposals

It appears that for the purpose of peer review and to cover the full spectrum of pluridisciplinary research, it is sufficient to consider at most three scenarios: A, B and C as outlined below.

The first two (A and B) are actually very similar and could effectively be regarded as one approach with slight differences in conducting the individual assessments and review panel ranking. All dedicated peer review processes for MICT proposals must include the opportunity for the applicants to exercise the right to reply to the remote assessments before the review panel meeting. Therefore all three assessments suggested below should include a step to collect feedback from the applicants.

Scenario A

For most multidisciplinary proposals (as defined in this Guide), a *central* or a *host* discipline may be *clearly identifiable* as being the main *driver* of the research objectives. In these cases the engagement of the other disciplines is seen as *supporting* or *complementary*. Within this scenario the resulting scientific discoveries, innovations, new knowledge or breakthroughs are expected to occur predominantly within the host discipline, facilitated by the support from the other disciplines; for example, development of new applications within the host discipline for concepts, methods, devices and systems that are primarily conceived within the complementing disciplines.

A suggested approach for Peer Review Implementation in Scenario A

For this scenario a two-stage process of individual assessments followed by panel reviews is recommended. The following features are suggested:

- *Stage 1: Individual assessments.* For this stage, one of the following two options may be considered:
  a) Matching of reviewers' profiles with research topics: if available, a sufficient number of experts (minimum of three) with appropriate depth and breadth of expertise to assess all the crossdisciplinary merits stemming from the interactions between the host and all the complementing disciplines. In this option, topical keyword matching may be used to identify the required profiles instead of matching of disciplines and profiles.
  b) Matching of reviewers' profiles with disciplines: include at least three individual referees from the host discipline plus one expert reviewer from each of the complementary disciplines. For this option, slightly different assessment criteria may be considered for the two groups of individual reviewers (from the host versus complementary disciplines) in order to sharpen the respective evaluations seen from the various disciplinary vantage points.
- *Stage 2: Panel assessment.* One review panel should synergise all the information and decide on ranking, prioritisation and the final decision. The membership of the panel will be from the host