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UKRI Research and Innovation Funding Service (RIFS) visioning work

Final report

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Executive Summary

Scope and purpose of this study

This report presents the findings of the visioning work for a new Research and Innovation Funding Service (RIFS) for UKRI. Technopolis was commissioned to carry out this work in order to support the business case for the RIFS and help create the best research and innovation funding service in the world.

Specifically, the purpose of this work was to provide evidence and practice-based input from an international comparative perspective, in order to highlight best practice and identify any innovative approaches in use in other agencies for consideration in a new RIFS. Our work has focussed on four core aspects of research and innovation funding:

- **Rules and standards:** where should the central organisation of UKRI end and the UKRI Councils' own 'identity' begin, especially with regard to facilitating more effective funding of inter- and multi-disciplinary endeavours?
- **Designing calls and schemes:** how to have a user-friendly, standardised approach, which enables creativity and flexibility, but also ensures the portfolio of schemes and calls is fully transparent?
- **IT systems:** grant management and monitoring of data from inputs to impacts and integration with other (external) data sources
- **Peer review:** how to operationalise this cornerstone of science funding in the most efficient and effective way

The brief for this study entails appraising international practice and highlighting best practice, hazards and important matters for consideration. However, it does not extend to the detailed design of future systems and solutions. In short, this report covers the 'what' and the 'why', while the 'how' will be the subject of future steps to be taken by UKRI.

We highlight best practice in all relevant areas. However, this is not to imply that UKRI does not already follow best practice. Where this is the case, our findings will provide context and confidence to UKRI's approaches, whilst in other cases they provide suggestions and guidance for change and optimisation.

Headline findings

Most funders centralise many aspects of both operational and research strategy. This enables greater organisational efficiency and coherence from both internal and external perspectives, the latter being critical for funding multi- and inter-disciplinary endeavours. Centralised creation of cross-cutting programmes (which is the norm) does however impose the need to seek input from different parts of the research/innovation community (which in the UK context would foremost involve the UKRI Councils) in order to secure buy-in.

Given the wealth of experience and intelligence of the UKRI Councils, there is a clear place for each one to retain a degree of autonomy on rules and policies, especially in relation to field-specific criteria-setting and in creating calls, programmes and strategies that pertain specifically to the fields of science for which they are respectively responsible, and for 'bottom-up' inter- or multi-disciplinary endeavours.

The RIFS will need to address the conflicting needs of increasing the range of tools to support a growing array of missions and aims, whilst also ensuring that the range of different funding tools is small enough to be comprehensible to applicants, and internally manageable.

Very few funders have tools that enable fully on-system design of a wide range of call types, so UKRI could move to the very forefront of developments here.

There is a genuine choice between two approaches here: either a selection of fully pre-designed call templates with an additional option to design more unusual calls from scratch, or a finite set of partially pre-designed call templates with some customisable aspects in each. The former option risks

proliferation of designs ‘from scratch’, the latter requires appraisal of what exact call aspects need to be customisable and what aspects can be fully standardised.

Funders across the world are moving towards modernised and fully joined up modular IT systems that facilitate all steps from call design and launch to application, processing, reviewing, awarding and monitoring of awards, outputs and impacts. Our consultations for this study suggest that an IT-system update of this type is among the most critical needs for the RIFS.

In the past, systems built from scratch or combinations of different software tools were the norm, including for instance CRM systems were that were only partially fit for purpose. Recently, there is a growing number of software vendors offering grant management systems, and a few have reached a level of sophistication that could make them appropriate for the scale of UKRI’s operations. We detail at several points in this report the kinds of functions that such a system would need to fulfil. User-friendliness for all system users (e.g. UKRI staff, applicants, reviewers) is a critical requirement.

Linking these systems with external databases (notably research information systems) is likewise a key priority, so that research information can be harvested from existing repositories (incl. Scopus/ WoS/ Patstat, etc). However, interoperability through common identifiers and data standards is a more likely direction of travel than full integration, not least due to problems around data protection.

Peer review is the internationally recognised standard to assess scientific excellence. With increasing competition for funding, research and innovation agencies around the world are engaged in various attempts to make the peer review process as efficient as possible in order to reduce the burden on the scientific community (e.g. through better IT systems to facilitate fully digital remote review and controlling how many applications go through to peer review).

A greater range of tools and missions also means that assessment techniques other than remote review are becoming more common, including multi-step assessment processes (consisting of e.g. an initial panel review to ‘sift’, followed by remote peer review). There is a need to consider systematic approaches to deciding what assessment techniques (or review sequences) to use for what kind of awards, and the role and remit of each assessment technique (e.g. which particular assessment criteria to assess, what parts of an application, and with what ‘weighting’).

When used appropriately, different assessment techniques (short first-round proposals, interviews, remote review, user panels, etc.) can fulfil a range of functions, including demand management, easing the peer review burden, ensuring a good fit with a call’s thematic remit, optimised risk management, as well as the greatest possible degree of fairness and optimal selection.

Recommendations and next steps

The concluding section of this report contains our full list of recommendations in each of the four core areas we have considered. The brief that we received from the project team in creating this report was to:

- Provide an independent view of what is possible
- Challenge the RIFS project teams thinking
- Identify alternatives that could be considered.

The next step for UKRI in our opinion is to use this report to challenge current thinking and consider any alternatives that have been suggested when developing requirements for the new service.

1 Introduction

Technopolis has been commissioned by UKRI to assist in the development of a new UK research and innovation funding service (RIFS), by providing evidence and practice-based input from an international comparative perspective on several issues identified as important in the new service design. The work is to feed into the business case for the RIFS.

Our work has focussed on four aspects of research and innovation funding, identified and agreed upon at the project's kick-off meeting on 27 March 2018. These are:

- Rules and standards: where does the central organisation of UKRI end and the UKRI councils' own 'identity' begin?
- Designing calls and schemes: how to have a user-friendly, standardised approach, which enables creativity and flexibility, but also ensures the portfolio of schemes and calls is fully transparent
- IT systems: grant management and monitoring of data from inputs to impacts, integration with other (external) data sources
- Peer review: how to operationalise this cornerstone of science funding in the most efficient and effective way

We also considered further areas of interest that may permeate through several or all of these main themes: demand management, multidisciplinary endeavours, transparency, evaluability/evaluation infrastructure, policy structures and decision-making processes. These were kept in mind as areas of interest throughout, and this report addresses them where relevant.

Our work has been supported by a panel of international experts (see section A.2 of Appendix A), who reported at several stages of this project on many elements of research and innovation funding services. They provided perspectives on a selection of international funders, which are noted below.

Table 1: Overview of comparator funders

Abb.	Country	Full funder name	Notes	Annual budget*
FWF	Austria	Austrian Science Fund	Research funder – connection to FGG to be noted on relevant issues	£175 m (est.)
FWO	Belgium/FL	Research Foundation Flanders	Research funder – connection to VLAIO to be noted on relevant issues	£298 m (2017)
ERC	EU	European Research Council	Research funder only	£1.58 bn (2018)
AcaFi	Finland	Academy of Finland	Research funder – connection to Tekes to be noted on relevant issues	£336 m (2017)
ANR	France	Agence Nationale de la Recherche	Research funder only	£522 m (2016)
DFG	Germany	Deutsche Forschungsgemeinschaft	Research funder only	£2.63 bn (2016)
FNR	Luxembourg	Fonds National de la Recherche	Integrated research and innovation funder	£56.7 m (2018)
NWO	Netherlands	Netherlands Organisation for Scientific Research	Research funder – connection to RVO to be noted on relevant issues	£800 m (2016)
RCN	Norway	Research Council of Norway	Integrated research and innovation funder	£890 m (2017)
VR	Sweden	Swedish Research Council (Vetenskapsrådet)	Research funder – connection to Vinnova to be noted on relevant issues	£557 m (2017)
SNF	Switzerland	Swiss National Science Foundation	Research funder – connection to InnoSuisse to be noted on relevant issues	£696 m (2016)

*Original budgets are in national currencies. All converted using European Commission exchange rates for 04/2018

Additionally, we conducted desk research and consultations with other funders in the UK and overseas, notably on the issues of peer review and grants management systems. These include:

- National Science Foundation (NSF) – USA
- National Institutes of Health (NIH) – USA
- Australian Research Council (ARC)
- National Research Council (NRC) – Canada
- Cancer Research UK (CRUK)
- Royal Society
- Wellcome Trust

We have also carried out ten stakeholder interviews with key individuals within UKRI and several of its constituent organisations and departments. The details of these are noted in section A.3 of Appendix A.

This document presents the findings of our work: the first main section presents the international landscape and best practice in each of the four areas covered by our work. Elaborations on each funder considered by our expert panel are appended to this report (Appendix B). Section 3 includes a brief overview of the currently envisaged parameters of the RIFS (see section 3.1), which has been checked and agreed by UKRI. This is followed by an extended reflection on the future needs of the RIFS (section 3.2). The concluding section 4 lists our recommendations for the RIFS.

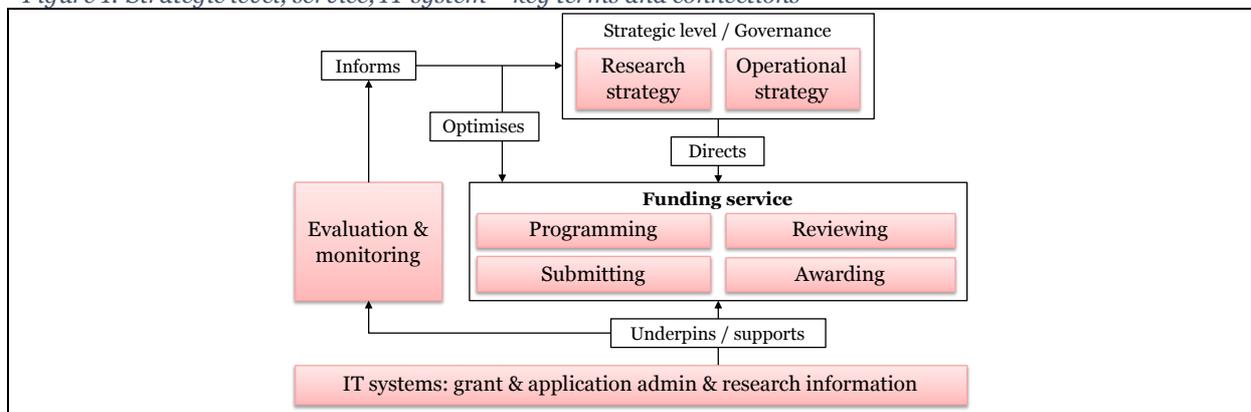
1.1 Clarification of key terms

It is worth briefly highlighting the key terms, so that the scope of this study is clarified. Funding service refers to the delivery of the fundamental business of an R&I funder, the focus being on the satisfaction of the needs of the users within UKRI and in the wider academic and industry communities. This is composed of several sub-components, notably programming (agreeing on, designing and setting up calls), application submission, reviewing and awarding (the latter including the lifetime-management of awards).

Critically, the service is underpinned by IT systems. These support the whole process and as such need to be seen as an important underlying component of the funding service. IT systems also aid evaluation and monitoring, and as such also serve aspects that are not strictly part of the service itself. Nevertheless, a new funding service cannot be contemplated without giving thought to the underlying IT system to support it.

The strategic level (including UKRI and UKRI Councils) directs the activities of the funding service, e.g. in terms of operational strategy, and which strategic priorities or missions/challenges to target ('research strategy'). It too is separate from the funding service, but the way the strategic level and the service interact is in itself an important part of the service design, so we refer to it where relevant.

Figure 1: Strategic level, service, IT system – key terms and connections



2 Funding services: four issues in international comparison

In this section we outline the current international state-of-play in the four areas under consideration in our work. The information is based on the input from our expert panel. In brief, we note the following headline conclusions in each area:

- Both operational and research strategy tend to be largely centralised, leading to greater organisational efficiency and coherence, both from internal and external perspectives, the latter being critical for funding multi- and inter-disciplinary endeavours. However, there is a clear place for discipline-specific departments to have their own rules and policies, especially in relation to field-specific criteria-setting and in creating calls, programmes and strategies that pertain specifically to the fields of science for which that department is responsible. Centralised creation of cross-cutting programmes (which is the norm) does however impose the need to seek input from different parts of the research/innovation community in order to secure buy-in
- Funders face the conflicting needs of increasing the range of tools to support a growing array of missions and aims, whilst also ensuring that the range of different funding tools is small enough to be comprehensible to applicants, and internally manageable. Off-system approaches are still common when innovative call designs are created. Fully on-system ways to bespoke design a wide range of call types are very rare
- All funders seek to move towards modernised and fully joined up modular IT systems that facilitate all steps from call launch to application, processing, reviewing, awarding and monitoring of awards. Linking these systems with external databases (notably research information systems) is likewise a priority. However, interoperability through common identifiers and data standards is a more likely direction of travel than full integration, not least due to problems around data protection. Funders are at very different points in these systems evolutions
- Remote peer review is the internationally recognised way to assess scientific excellence, yet the burden of remote review on the scientific community is considerable. Funders are engaged in various attempts to make the remote review process as user-friendly and efficient as possible (e.g. through better IT systems and controlling how many applications go through to remote review). A greater range of tools and missions also means that assessment techniques other than remote review are becoming more common.

2.1 Rules and standards – centre and periphery

2.1.1 Organisational structure

The great majority of organisations have 3-5 departments (sometimes known as ‘divisions’) representing disciplinary areas (e.g. arts and humanities, social sciences, biological sciences, etc). This is seen as an important foundation to ensure proper funding of basic research and organising scientific review.

Integration of research and innovation funders into a single organisation is extremely rare. RCN is a notable exception and the FNR (Luxembourg) represents an integrated research and innovation funder to some extent, but typically innovation agencies are separate. However, there are very few fully separate research funding councils responsible for a disciplinary sub-set. Medical sciences in the Netherlands are an exception: funded by both the NWO and the ministry of health, research and innovation funding in this domain is integrated and carried out by a fully separate organisation.

The UK context is unusual among the funders we have examined in the sense that individual, discipline-based research councils have undertaken much programming and strategy development autonomously. International practice shows higher-level programming to be the norm (though there are exceptions, e.g. Sweden), especially as regards societal challenges and transitions from research to innovation.

However, the UK’s approach also means that the UKRI Councils have a wealth of existing insight and intelligence into their respective disciplinary research bases. Maintaining a degree of individual programming and strategising is therefore appropriate in the UK context: history and context matter.

There are usually centrally located organisational units responsible for matters such as equality/diversity, open access, internationalisation, planning & organisation, finance, etc., who set the rules, policies and standards for all parts of the organisation. Notably, such centralised functions pertain both to research strategy and operational strategy. Centralising these functions ensures streamlined processes and cross-over between different departments, making it easier for departments to collaborate and for applicants to apply to different departments.

Where individual departments retain a level of autonomy, this is usually around aspects such as funding and assessment criteria or strategic decisions around programmes and schemes pertaining only to the disciplinary remit of the department in question.

Most special programmes, centres or initiatives likewise are situated beyond discipline-based departments, and are often connected to the emphasis on cross-cutting, challenge-based programmes. In some cases (e.g. SNF, Switzerland) there is a special department for programmes, separate from the discipline-specific departments. In some cases, there are also stipulations that any such programmes must have input from more than one disciplinary department, or indeed, from all of them.

Whilst most organisations follow a research council model, including discipline-based departments and over-arching policy and administrative units and programming, Norway is an important exception. RCN is divided into a basic research department, broadly following a research council model, an innovation funding department, and space for programming and priority setting that effectively lies ‘in-between’ the two. Pure research and pure innovation are thereby kept somewhat respectively autonomous, but programming can coordinate between these two ‘poles’, allowing strategic planning and design around national priority issues from basic research to business support. In addition, RCN provides research and innovation policy advice to government, so it not only works as a government agency, but also as an expert advisory body.

2.1.2 *Decision-making, consensus-building*

Securing buy-in from the research and innovation community is a critical aspect of setting up programmes. Yet, ultimately decisions need to be made, even where disagreements persist. Funders use a range of different consensus-building and decision-making processes, and there tend to be different approaches for ‘bottom-up’ initiatives on one hand, and ‘top-down’ strategic programmes on the other:

- In some countries, there is significant decision-making from the political level of ministries, who stipulate the content of programmes, whilst the funding organisation executes standard procedures to then carry out the programme or call
- Councils internal to the funder often have an important role to play in decision-making. These can also draw on senior research council members of each of the discipline-based departments
- Communication and input from discipline-based departments, user communities, and research-performing institutions occurs in several organisations, in order to understand emerging research priorities and develop programmes. Ensuring that such communication takes place, while also having clear decision-making processes appears to be considered good practice in several organisations
- Inter/multi/trans/cross-disciplinary research is explicitly recognised by funders in several countries (e.g. in Belgium/FL, Finland, France). In these cases, there are separate panels and/or commissions responsible for themes that do not fall within the remit of any of the thematic departments
- Many funders include the academic research community in internal decision-making and/or strategy-setting processes. However, the extent to which this happens varies among countries. In Sweden, for example, most members of the three thematic research councils are elected by the academic community. In Germany the DFG Joint Committee, which oversees its thematic sub-committees, is mainly made up of politicians and civil servants on the federal and regional level, two of 39 members representing the Donors’ Association for the Promotion of Sciences and the Humanities in Germany.

2.1.3 Approaches to inter- and multi-disciplinary funding

For most funders, discipline-specific research is still dominant in the mainstream, although all of them recognise that some research could be of an inter-disciplinary nature. Most national research funders have introduced ‘thematic programmes’ (sometimes also called ‘strategic programmes’), which focus on societal challenges. These are cross-/multi-/inter-/trans-disciplinary (hereafter ID) by nature.

Funders that facilitate ID research usually follow up on a national-level research agenda, which provides the policy framework for funding non-discipline specific research. This mitigates the ‘silo effect’ of research disciplines in tackling topical societal challenges. Examples include France (National Research Strategy) and the Netherlands (Dutch National Research Agenda).

The process of assessing proposals in ID research varies among funders. Some have no specific ID panels and the proposals are evaluated by discipline-specific panels (however, the panel members can ask for opinions of experts from outside their discipline). RCN (Norway) and DFG (Germany) are examples of this. Having specific ID panels in place is not common. FWO (Belgium) is a rare example, having established a panel that handles exclusively ID research proposals. The ERC panels are not per se interdisciplinary, but if needed, proposals are passed through multiple panels. In Finland, the Academy is discipline-oriented but ID proposals are evaluated case-by-case and ID panels can be established ad hoc.

At the US National Science Foundation (NSF), some programmes are specifically restricted to ID research topics; in those programmes, a great deal of weight is given to ‘interdisciplinary’ aspects. Some other NSF programs, while not so restricted, explicitly encourage ID research and consider it as a positive factor. In programmes that do not specify ID research as a priority, positive review of the proposal will be based on the combined assessment of the project according to the NSF merit review criteria as per the NSF Grant Proposal Guide (GPG), and any other special criteria that may be part of the specific Programme Solicitation or Programme Description. In such programmes, ID proposals that advance the programme goals are encouraged and funded, and any ‘weight’ is based on the anticipated potential of the project, not whether it is ID or single-disciplinary in nature. If the proposal is not reviewed through an existing program, it will be reviewed using only the two NSF Merit Review Criteria: Intellectual Merit and Broader Impacts (that is, there are no additional programme-specific criteria to apply).¹

2.2 Designing calls, programmes and schemes

2.2.1 Challenges

The ambition to have a flexible yet efficient and transparent system for call, programme or scheme design places UKRI RIFS at the forefront of funding services: international comparison yields much diversity in how funders arrive at such designs, but a system of the type envisaged for UKRI appears in only one of the organisations we have considered here – the Australian ARC, whose new system took considerable effort and time to build.

An excessive range of tools can become unwieldy; yet, the ability to tailor scheme design to specific needs is widely valued. A comprehensive yet flexible system to do so may well be the way forward. UKRI RIFS would, with such a development, certainly be at the cutting edge on this issue.

The design of programmes, calls and schemes is an area where ‘best practice’ is especially hard to pinpoint, not least because the organisation of programmes, funding schemes and calls is strongly embedded into local institutions, rules and context.

In several countries, programme design is coordinated at the ministerial/policy level and research councils have less influence on the programme design (FWO, ERC, ANR and SNF). For example, in the

¹ https://www.nsf.gov/od/oia/additional_resources/interdisciplinary_research/faqs.jsp#Q3

case of Belgium/FI the FWO has no authority to decide on thematic priorities but can decide on the timing of calls.

In terms of transparency, the design of schemes and calls is usually done in-house, with a certain degree of discretion, but at various points the process may involve consultation with stakeholders. Some funders have been challenged for not having sufficient transparency and impartiality in the selection process and with regard to programme design.

Other funders (e.g. AcaFi, FNR) have more input and flexibility in programme design and procedures, making the system more bottom-up, open and transparent.

There is substantial variation in type and number of funding instruments available to researchers and the wider community. Most funders are confronted with two conflicting challenges: on one hand, the need for a greater variety of funding tools to reflect a growing range of strategic and thematic mission; on the other, the need to maintain an array of tools that is comprehensible to applicants and, indeed, internally.

In terms of trajectory, there are also different movements: the Luxembourgish FNR is growing its researcher base and exploring the options around having a wider range of instruments. At the Dutch NWO, the opposite is the case: procedures and calls vary substantially between the three different domains and are often adapted for individual calls (based on the conditions of different funders or the specific needs of the calls). NWO is being reorganised, not least in order to improve effectiveness, efficiency and coherence of calls and schemes, making procedures more uniform. The ERC has also sought to consolidate into a smaller range of distinct funding tools and standardise far more across calls.

2.2.2 *International approaches*

Some funders have a single default procedure for designing new schemes and issuing new calls for proposals, e.g. RCN, NWO and ANR, although ANR is currently reforming its procedure for designing new schemes and issuing new calls. The following present specific noteworthy examples:

- RCN (Norway) presents an interesting case, with 17 standardised award types (each with its specific award processes, depending for example on whether it has a research or innovation focus).² This presents a wide range of different instruments, which can be applied as suits the nature of the call, programme or scheme in question. Ad-hoc design of new types (or hybrids) of calls is feasible through an ‘other’ (or ‘sketch’) option. However, from next year this system will be changed into 7 broader award types, to simplify the system. A significant experience has been that the category ‘Other’ is over-used (around 30%), so the programme committees have opted to change to fewer, less strictly defined award types
- RCN (Norway) also centrally defines operational processes, enabling departments work to with various sub-sets of the overall common processes. This also enables RCN to run a common IT system from application to post-project monitoring. Designs are approved by the department boards and again by the main board. Calls use a standard procedure, with programme-specific texts and requirements that correspond to the assessment criteria
- The NWO has a standard procedure and a toolbox set of instruments to choose from, but there is a lot of variation in how this is used. The set of instruments will be harmonized to create a limited number of instruments with modules that can be added and combined to adapt to the needs of each programme. The instruments to choose from will be: talent programme; open competition; programmes for scientific or societal breakthroughs; public-private partnership programmes;

² Six core R&D project types, plus feasibility study support and support for writing proposals to the FP; Five kinds of personal stipends (PhD, post-doc and mobility); Two types of institutional support: for research infrastructure and for strategic development of new research areas; Four ‘other’ instruments: event (conference) support; ‘other support’ (used for centres of excellence, mainly); applications for grants not funded by RCN (it acts as an implementation agency for some others); and ‘sketch’.

specific programmes and infrastructure programmes. Modules include: personnel; materials; investments; knowledge use; internationalising; citizen science.

- Finland has a separate process for designing a new funding scheme and designing a new thematic programme. Funding scheme design requires a political decision and is managed in collaboration with the ministry. Design of thematic programmes is the responsibility of the Academy itself, except for strategic research, where the thematic selection is done by the government. The application of open consultation in designing thematic programmes has made the programme process more systematic. The same basic approach is used for all thematic programmes. Traditionally, thematic programmes consisted of one or more open calls. Programmes are used as a platform for international collaboration, so they increasingly include additional calls implemented in collaboration with funding organisations from other countries (e.g. ERA-NETs, joint bilateral calls)
- Business Finland (formerly Tekes) has a systematic programme design process. New schemes are less frequently designed and therefore may include ad-hoc steps. However, the overall decision process is relatively clear, including collaboration with the ministry.

Across the board, there is no standard process for finding agreement on the design of calls. Agreement on the process for the design of schemes and calls is usually approved at a higher level, e.g. by a division board (RCN), Ministry of Education (VR and FWO), Executive or Domain boards (NWO), Federal Council (the SNF's NRPs), or an Executive Board (FWF and DFG). The exception is Finland, where Research Councils have a lot of freedom to decide about call design and it is argued that there is no need to reach Academy level agreement regarding calls. There are some examples of organisations that have set up a mechanism for researcher input:

- In Norway, RCN has a mandate to act as a 'meeting place' and hosts meetings and conferences involving stakeholders in discussions about research results, needs and policy on a continuous basis. Information is used by RCN in planning and in negotiating with the ministries about programmes and budget. This complements the 'top-down' input on programming from the government and ministries with 'bottom-up' input from the stakeholders
- In Finland, AcaFi launches open consultations where researchers can make suggestions on programme design
- In France, ANR organises since 2017 a 'road tour' to meet researchers.

Most organisations do not have specific tools to help shorten the time from scheme inception to the announcement of the call but do not consider the time taken to launch a call to be an issue. Depending on funder and programme type, timeframes range from about 5 months up to four years for more complicated programmes that require extensive consultation and feasibility studies.

The experience of Finland suggests that the focus should not be on shortening the process but on making sure the call is of the right quality. One suggestion is that open calls can help shorten the time to launch. Convening a sufficient number of board meetings is also suggested to help shorten the timeframe.

2.3 IT systems

There is a critical need to consider, on a continuous basis, the evolution of the IT system of the RIFS. Funders recognise the merits of a fully integrated, interoperable system that draws on existing data wherever possible, and are engaged in catch-up with technological possibilities. This also means that any system-overhaul would need to ensure a certain open-endedness: further integration of new data sources and new types of analysis need to remain possible. As users become more data-savvy, the outward-facing part of the system becomes more important and opens many possibilities for analysis and accountability. Internationally consistent ID systems (such as ORCID) and the ability of the system to leverage other open data resources is a case in point: currently uptake is not yet sufficiently widespread that this could fully substitute funder-internal ID systems. However, systems need to be responsive to the fact that this may in the medium-term future become the case.

2.3.1 *The drive towards integration*

Across all organisations, there is a drive towards fully integrated IT systems that combine as much information as possible – and fulfil as many functions as possible – within one and the same system. A clear emerging standard is that submission of application, peer-reviewing, financial information, monitoring and logging of outputs should all be done in a single, comprehensive system, allowing also cross-analysis between these parts of the operation.

Different IT functions such as data entry, data warehousing, analysis, and publication to the funder's website (either statically or as a searchable online database), will be dealt with in a variety of technical solutions. In this environment interoperability and the use of standards is key. There are two different main models and levels of integration: fully integrated internal systems comprising both submission information and project/grant lifecycle information, or separate systems for submission information and for information on projects/grants. Systems internal to the funder (financial, HR, etc.) are separate from the systems used to manage the funder's programme.

Different organisations are at different points in this development. Several have found their systems to be sub-standard in recent years and are engaged in various processes of system overhaul or optimisation. Others have completed such renewals relatively recently. Both continuous improvement and one-time system overhauls are occurring. Indeed, these do not exclude each other: a one-time overhaul may be necessary to make a system fit for further improvement and integration efforts.

2.3.2 *What do the systems do?*

User-friendliness for all concerned is deemed critical. Likewise, there needs to be scope to include or exclude types of data that may be specific only to some disciplinary areas or award types.

Systems from the reviewed funders typically contain information on grant applications, project information and people and participant organisations involved in each of the projects/grants. There is an emphasis on capturing information on the different roles within a specific project, but sometimes information about the types of organisations is not captured consistently. Information about research groups is also not captured consistently. Changing organisational structures and changing affiliations are a challenge for the funders' IT systems to keep track of.

Some of the funders capture comprehensive information on the use of research infrastructures and final report data including outputs, outcomes and follow-up funding, in a system of outcomes similar to ResearchFish. FWF (Austria) is currently implementing such a system, which is expected to be operational from autumn 2018 onwards.

Most newer systems build on the CERIF standard (or subsets of it) for representation of research information. Usually the grant or project is at the centre of the system, however if the system is using a data model based on the CERIF standard, then information can be seen from many different perspectives. For some funders the tracking of multi-award projects or the tracking of follow-up projects takes some semi-automatic or manual work. Often, the information is in the system but queries are not set up for a particular analysis that may be run sporadically for evaluation purposes. What is important is the presence of unique identifiers for projects, people, organisations and follow-up funding so that these analyses are possible. Some funders leverage on the development of open databases of research organisations that can be used to link funder information to other datasets.

There are important points regarding data privacy, especially in light of the new GDPR regulations: the tracking of specific people (particularly across different funders) is challenging because of privacy laws and because keeping data for the longer term requires justification for the need to do so, and for the longer term uses. Beneficiaries will have to give consent to their personal information being used for tracking and analysis purposes.

Most funders capture publications and patent data (or at least unique identifiers about the outputs that would allow an analyst to retrieve the information from other datasets). In general, other information about outcomes and impacts is captured as unstructured text information in the form of documents (e.g.

pdf final reports) or free text descriptions captured in forms and datasets. This presents a challenge for analysis of these assets, which is done mostly sporadically as part of evaluation exercises, although some funders (e.g. AcaFi) have started developing and using tools for document content mining to allow further analysis of these outputs and impacts data.

Usually, periodic reporting of funded projects is done continuously during the lifetime of any research project based on clear provisions stated in the grant agreement that bind the beneficiaries to such reporting requirements. This leaves out unsuccessful applicants, which poses difficulties for the construction of robust counterfactual groups for evaluation purposes (i.e. comparing successful vs. unsuccessful applicants). Funders do not seem to have a solution for this, though in the long-run ORCID/CrossRef may provide opportunities for robust counterfactuals.

In terms of completed projects, most funders expect scientific publications to be reported for a few years after the grant has ended, partly also due to the delays of the publication process itself. Some funders mention that they have additional reporting requirements for some types of grants (e.g. technology valorisation, innovation) where there is a clear rationale for asking about performance a few years after the grant has concluded.

Whilst much of these systems is essentially inward facing (i.e. aiding the award process and evaluation), some funders also have outward-facing elements to these systems:

- The Swiss SNF's P3 system has an outward-facing platform, where information about funded projects, people and publications can be viewed by anybody. There are also interactive tools to show international collaborations and other facets of the SNF-funded activities
- RCN (Norway) likewise has an outward-facing grants database, including qualitative information on awards, which acts as a basis for evaluation, but also as a convening-point, allowing anyone to locate research activities they might be interested in
- The Swedish Research Council also provides information about grants, researchers and organisations through the Swedish national CRIS SweCRIS. This new system also integrates the data of 11 other funders across Sweden.

2.3.3 *Integration with external systems*

Whilst there is near-universal agreement that integration and inter-operability between funders' research information systems and other, external data repositories is key, in practice this is only happening to a limited extent.

In general there is no integration as such with external databases, but links can be maintained across datasets via the use of unique identifiers. The integration of systems across organisations or external partners can be problematic (and often not feasible) due to privacy and security regulations.

Usually systems have a modular architecture that allows them to be connected to other systems to track the outputs and outcomes of projects, mainly publications and patents, through the use of unique identifiers (e.g. DOIs, patent application numbers, etc.) It is presumed that all the funders have easy access to all these subscription-based resources (Web of Science, Scopus, PATSTAT, etc.), in addition to their own internal datasets.

However, there is limited evidence so far of further interoperability (for example with Web of Science, Patstat, etc). The ERC is among the most advanced in this sense, engaging in continuous development, driven in part by the need to demonstrate the added value of its funded projects. Likewise, the Swiss SNF allows award holders to harvest publications data through ORCID and CrossRef, though the onus is still on the award holder to do this, rather than being a fully automated process. The ARC (Australia) has a similar functionality, also using CrossRef. Funders are striving to make better use of unique identifiers to facilitate these interoperability tasks.

Integration beyond internal research information systems is also limited, but there are cases where this is done. Most often, this integration relates to inter-operability between funding and research

performing organisations. In other words, universities and research institutes enter their outputs or awards data into national systems, which are integrated with the funders’ own system.

Integration of grant information of different funders is likewise rare, and data protection laws (strengthened significantly by GDPR) make this an even more challenging task. Rather than fully integrating as such, the trend here is more towards different funders conferring and agreeing on shared research information platforms, where award information suitable for shared data-handling (and indeed, for the public domain) can be pooled. The ARC goes in the ‘opposite’ direction, sharing with institutions and other organisations those aspects of its awards data that is not subject to privacy laws.

There is no evidence of full integration of IT systems of separate research and innovation funding agencies, though integrated funders (RCN, Norway and FNR, Luxembourg) do have joined up data operations. VR, Forte and FORMAS in Sweden have a shared application portal, but other modules are separate: research and innovation awards have different data needs and likely different outcome and impact measures. In the same way, systems need to have a way for different scientific disciplines to capture different metadata. This is even more pressing for a system that can capture the programmes, grant cycles and outcomes of both research and innovation funding streams.

2.4 Peer review

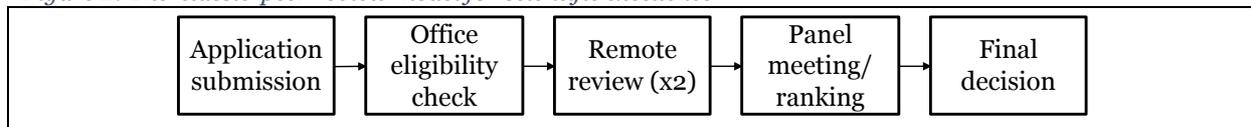
2.4.1 The gold standard of peer review for scientific excellence

The established, discipline-based peer review system (comprising remote peer review and review panels) continues to be the foundation of much research funding and is seen as a gold standard to ensure funding of excellent research. Yet, there is a universal admission that peer review is a significant burden on the research community.

There is little deviation between different funders in terms of the peer review process for scientific research. The formula adopted in almost all cases involves submission of applications, followed by eligibility checks (office approval), remote review (usually by two or more peers), and final input by a research councillor/panellist, grading of proposals at a review panel, and a funding decision. Interview panels and site visits are used in very few cases due to resourcing.

Internal funding staff are responsible for eligibility checks in all instances and also deal with finances, monitoring and reporting. Formal evaluations of processes or outcomes are done by internal review boards. Extra support is sourced as needed if some eligibility criteria requires scientific expertise (FWO). In one notable case, a lot of the initial eligibility is checked using an IT system to lessen the burden on internal staff (ERC).

Figure 2: The ‘classic’ peer review model for scientific excellence



Funders use either numerical or grading scales to appraise applications’ quality. Rubrics are published with accompanying definitions of each ‘band’ as reviewer guidance.³ These rubrics can also come with general guidelines for quotas within each scoring/grading band, such as the FWO (Belgium) who use a system from D (not to be ranked – bottom 50% of applications) to A+ (outstanding – top 5% of applications).⁴ Top-rated applications as well as the other high quality fundable applications are put to the final decision-making body and a ‘cut-off’ point on the ranked list is determined by the availability of funding.

³ See e.g.: http://www.aka.fi/globalassets/20arviointi-ja-paatokset/liitteet/instructions_for_reviewing_research_applications_individual_reviewers_2017.pdf

⁴ FWO ‘Guidelines for panel members’ (p. 4) - <http://www.fwo.be/media/227150/Guidelines-for-panel-members.pdf>

Awards are almost invariably made in funding ‘rounds’, rather than on a fully continuous basis, driven by the need to convene panels, and to choose among a sufficient number of competing applications. However, application submission often occurs on a continuous basis (i.e. applicants can submit anytime they want, but decisions will be taken by panels on set dates). Calls that are open on a continuous basis tend to be analogous to ‘response mode’ funding, or other non-thematic awards such as mobility grants.

Funders typically select from existing pools and committees of internal panellists/research councillors and external (remote) peer reviewers, seeking specialised external expertise on an application-by-application basis. Especially in smaller countries, the population of remote reviewers and panel members is very international to further ensure independent review quality and avoid conflicts of interest: 95% of AcaFi’s external expert peer reviewers are non-Finnish, for example. All of these roles are voluntary.

Academic experts are crucial for all panels to assess scientific quality. Non-academic stakeholders qualified in the research area (commercial and NGO representatives) are sometimes invited to panels if domain relevance and capacity-building perspectives are needed in thematic programmes. There are typically efforts to ensure reviewers of more innovation-focused projects include non-academics aware of markets, business potential and innovativeness of the targeted products, processes or services. Funders often struggle with this, as independent reviewers with sufficient industry experience and insight are often quite challenging to find. Especially for programmes geared towards innovation or societal challenges, greater use is made of assessment panels, which can also include user-community representatives, rather than only academics.

These processes are generally transparent in terms of reviewer guidance documents and expert panel membership being published online, explaining the peer review processes. It is more difficult to identify whether individual scores and feedback are reported to applicants for their continued development.

2.4.2 *Optimising review processes*

Given the trust in the ‘classic’ remote peer review process for the task of assessing scientific excellence, little can be done to structurally change this particular and most burdensome aspect of application assessment. Much more scope for new processes and approaches exists in the use of panels, interviews and other techniques. Yet, funders make efforts to limit the burden of remote reviewing in several ways, by ensuring a user-friendly process, and by exercising a level of control over which applications go to remote review in the first place.

The average time to project start from application is around 6-8 months and is very consistent across funders. Tightening assessment procedures and setting targets for this indicator appears to work well (NWO, ERC) whereas slow remote reviewer responses extend the time, meaning that this is the most significant point for investigation in terms of shortening time-to-grant.

The smooth operation of remote reviewing needs to be ensured, and interoperable and user-friendly IT systems are a key part of this. It is increasingly becoming the norm to integrate remote reviewing into the same system that also deals with application, administration, reporting and monitoring, so that reviewers receive applications and enter their feedback and grades on the grants management system via their sign-in.

Reviewer response rates tend to cluster around 20-30% in most cases. Many funders have recruited overseas remote reviewers to improve rates, which has worked for some (NWO, FWF), or are recruiting more reviewers generally (DFG, FNR). Additionally, modern grant management systems increasingly have the ability to track response rates from individual reviewers, so that funders can ‘learn’ which reviewers are likely to actually respond and which ones ought not to be contacted due to previous experience of non-response. This is rare at this point, but the UK national academies’ new FlexiGrant system has this capability. The ARC’s new system additionally allows automated scanning for conflicts of interest (based on reviewers’ previous and current institutional affiliations and their own awards information), and has the capacity to use text-mining of previous applications to better link applications to suitable reviewers.

There is a tendency towards two-round assessment processes, where the first round involves a short application (typically in the range of 4-5 pages). For the most part this happens in specific programmes (for instance the NRPs in Switzerland). However, ANR (France) has recently implemented a new two-step approach across its response mode equivalent funding.⁵ Such approaches can help scan for different assessment criteria in each stage, but can also help limit the number of applications that go to remote review. Such short application rounds can involve either remote review and a panel, or panel review only. The former approach ensures greater scrutiny, the latter saves time and review effort.

Using shortened applications for initial sifting rounds is a growing trend, and the advantages (e.g. reduced burden on unsuccessful applicants, lower entry requirements to allow for more extensive and inclusive submissions, better targeting of grants on the best and most relevant) and potential hazards (e.g. higher rate of applications, reduced detail to make decisions) need to be weighed up when assessing whether to make use of such approaches.

To prevent excessive application submission by individual applicants, NWO (Netherlands) are considering limiting how many grants one individual can hold at once. The SNF (Switzerland) already has such a limitation. At RCN, PIs are limited to one application at a time in order to improve application quality, although they can be involved on other applications if they are not the PI.

Likewise, a full panel review is not always convened: if the grants are small and frequently awarded, internal/external peer review is sometimes deemed sufficient. At the other extreme, where relevant to a particular programme, decision-making is sometimes conducted by panels or research council committees who take into account policy priorities.

There are few instances where remote peer review is by-passed completely, except in the cases of very small grants (FNR, AcaFi) and typically in more innovation-focused areas. There are only very few instances where neither remote reviewing nor review panels are used (the US NSF's SGER awards being a rare example where awarding is at the discretion of programme directors).

Interviews are rarely used. Typically they come into play under two conditions: either when grants involve significant project management, at which point interviews become an additional assessment step, or for small awards such as some early career initiatives, where an interview becomes the main assessment step, in preference for example to extensive remote reviewing. At NWO, interviews are regularly used for personal grants.

Despite the technical possibility to have remote panels, they still meet physically in almost all cases, owing in large part to the need for communal discussion, which is still deemed to be much more effective face-to-face (though there appears to be little concrete evidence for such inferred deficiencies of 'virtual' panels). However, NIH makes some use of teleconferencing, especially for awards that require significant international expertise. A further exception is when applications are judged individually remotely, but then combined and fed back to remote 'panellists' using the Delphi method (NWO).

⁵ Stage 1 consists of a 4-page description of the proposal and stage 2 (if short-listed) a max. 20 pages description of the project.

3 UK RIFS – an appraisal

The international comparative analysis conducted for this study enables us to highlight best practice and ideas for consideration, as well as areas where the ambitions for the RIFS are genuinely novel and unique. It also enables us to point out potential hazards in the design and implementation of a research and innovation funding service. Translating the comparative findings of the previous main section into concrete implications for the RIFS will be the central task of this section.

3.1 The UKRI RIFS – overview of the proposed service

To give context for this task, we provide below an outline of the UKRI RIFS based on our understanding, gathered through our exchanges with the team supervising this work from the UKRI side, documents pertaining to the business case for the RIFS (most notably the RIFS Consultation Document dated March 2018 and the RIFS Skeleton Outline Business Case version 0.2), as well as additional consultation interviews with senior staff at UKRI and the UKRI Councils (see section A.3 of Appendix A). This overview has been checked and agreed by UKRI.

- The RIFS should be a simple and unified service that flexibly supports UKRI funding ambitions, builds upon current good practice and partnerships, widens evidence-based decision-making, frees up more time for value added activities and helps achieve world class outcomes for the UK
- A service that supports discipline-specific and multi-disciplinary research and innovation funding
- It must also be responsive to the growing importance of ‘top-down’ strategic, challenge or mission-based research and innovation funding, recognising that all UKRI Councils are actively engaged in promoting research and innovation through different mechanisms
- More broadly, inter- and multi-disciplinary and ‘cross-cutting’ research and innovation must be easily facilitated within the service
- The service must allow for a wide range of funding opportunities to be designed on-system, both by UKRI Councils and at UKRI-level (top-down and bottom-up). Bespoke combinations of service components (from eligibility to application and assessment) need to be assembled easily
- The service needs to reflect a joined-up, common approach across UKRI Councils in as many aspects as possible, whilst also supporting individual UKRI Councils’ strategic needs
- The service needs to be flexible enough to accommodate a wide range of different funding organisations and individuals, including private sector and overseas partners and academic institutions. Yet, the checks and balances necessary to cope with this diversity should not become unduly burdensome or obstructive for any one user
- To support this unified service concept, there also needs to be a fully integrated IT system operating across all UKRI Councils, which needs
 - To cover all aspects of the funding process from call design to application, reviewing, scoring, financing, monitoring and reporting of outcomes
 - To allow appropriate data to be captured and re-used to minimise the data entry burden
 - To have the potential to be linked to external data sources (e.g. HESA, other funders, institutional IT systems, worldwide research information systems), so that duplication of data entry is avoided (efficiency, accuracy) and UKRI’s own data analyses can draw on the greatest possible set of resources
 - To be flexible so that new functionalities and data sources can in future be integrated into the system, especially as technological advances elsewhere (and evolving international standards) increase the potential power and efficiency of research and innovation management systems (e.g. ORCID, Altmetrics)
 - To allow for appropriate levels of monitoring and evaluation. Providing the ability to track the activities, outputs and impacts not only of individual grants/loans, but of groups of connected

grants/loans ('projects'), individual awardees or groups of awardees, or any other potentially relevant unit of analysis. This will enhance evidence-based decision making and provide greater analytical capacity to explore and reflect on the effectiveness of different interventions and their impact

- Peer review is critical to ensure funding of excellent research and innovation. The RIFS should ensure that the peer review processes (including remote reviewing and panel decision making) are as user-friendly as possible. This means
 - That all peer review activities can be conducted on-system, making peer review as easy and user-friendly as possible
 - That remote reviewers and panel members can be located easily, potentially with the help of research information systems
 - That peer review scores and feedback can be entered into the system in a fully paperless fashion
 - That reviewer response rates are as high as possible
- At the same time, there need to be further measures taken to address the limits of peer review, both in terms of the burden on the research community, but also in terms of the deployment of funding criteria additional to scientific excellence, where traditional peer review may not be the only (or best) way to take advice and reach the optimal funding decisions.

3.2 Implications for the RIFS from international comparison and best practice

3.2.1 Directions for the strategic level

Whilst most of the substance of our work focuses directly on the funding service and the underlying IT system, there are a few points worth making about the strategic level of UKRI and the UKRI Councils, inasmuch as this level connects to the operation of the RIFS itself:

- A smoother and more unified funding service will be enabled, if certain policy areas are unified at UKRI level. This includes elements relating to both operational and research strategy, notably equality/diversity, open access requirements, eligibility criteria, compliance issues and financial regulations, and periodic reporting duties for award holders. Our comparator funders all centralise most or all of these aspects (and more) across different disciplinary departments, and there are clear efficiencies to be gained by ensuring that such policy areas are harmonised across the board, i.e. centralised. For the RIFS itself, this will eliminate many cases of multiple different policy requirements, and will also ensure applicants are not confronted with new policy and operational landscapes if they choose to apply, for example, outside of their core disciplinary area (i.e. to a different UKRI Council than they are used to, or to a cross-cutting scheme)
- Though it is rare for individual, discipline-based departments of funders to maintain independent capacity for strategy formulation and individual policies, the rich history and experience of the UKRI Councils present a case for each to maintain more autonomy than is typically the case. Specifying the details of assessment criteria (e.g. what might constitute excellent research or major research impact), grant size and other factors that may be specific to certain disciplinary areas could usefully remain within the remit of the UKRI Councils. The same goes for funding programmes and schemes that pertain solely to the remit of a single UKRI Council, or to only a small subset of councils (a special case we consider under the heading of interdisciplinary funding)
- Weighing up the relative balances of importance between different priorities such as scientific excellence, RoI, impact, strategic/thematic relevance and others cannot be done in a uniform way across all of UKRI's activities. Likewise, this is not an area where distinctions between each UKRI Council would be helpful. Instead, the balance between such different ambitions needs to be struck at the level of each individual call or programme, notably in the shape of assessment criteria and their respective weights. In other words, strategic commitments to excellent research, impact, economic growth, relevance to particular societal challenges/missions are rightly made at the level of UKRI, supported by each UKRI Council's additional strategy, but how these commitments are

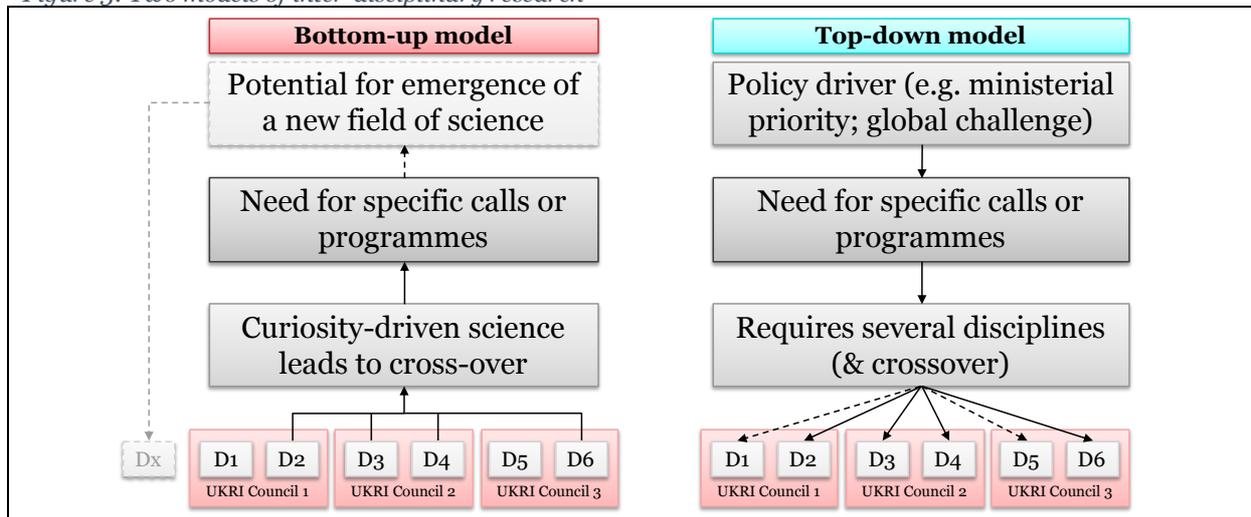
weighed up is dependent on the aim and nature of each individual call. We discuss the importance of clarifying assessment criteria and aligning these with the assessment process in the section on call design below.

3.2.1.1 Interdisciplinary activities

Part of the UKRI ambition is to facilitate more inter- and multi-disciplinary activities across the R&I funding spectrum. Creating a unified funding service and centralising certain aspects of policy are factors likely to contribute to this aim in themselves, as applicants chiefly familiar with the service of one UKRI Council can comprehend and manoeuvre through the call of a different UKRI Council with more familiarity. However, there are other considerations to be made.

Foremost, it is important to note that interdisciplinary research can have one of two quite different rationales: on one hand, interdisciplinary research can be a bottom-up, science-driven ambition. This is the case when curiosity-driven research activities lead to fusions between particular disciplines (or sets of disciplines), potentially leading to entirely new fields of scientific research.⁶ On the other hand, inter- or multi-disciplinary endeavours may be the results of top-down strategic or mission/challenge led programmes, where the nature of the programme ambition is such that a multitude of disciplinary perspectives becomes necessary.

Figure 3: Two models of inter-disciplinary research



UKRI already has extensive experience of cross-council research and programmes of work and has utilised different funding models to do so. However, it is worth illustrating two fundamentally distinct approaches.

In the 'bottom-up' case, the existing expertise and intelligence of individual UKRI Councils should be drawn on to the greatest possible extent. Where new fields of potentially important interdisciplinary research are emerging, it should be up to the specific councils related to it to, for instance, launch special calls, pool council-specific budgets, assign a lead-council, convene special panels, and so on.

For the latter case, a different approach is needed. Across our comparator funders, thematic or challenge/mission oriented programmes are almost always (1) of an inter- or -multidisciplinary nature and (2) organised centrally rather than by one or more discipline-specific departments.

This approach is best practice, as it ensures individual UKRI Councils do not take excessive ownership of such cross-cutting programmes (or indeed, become unduly disadvantaged). Moreover, it can facilitate

⁶ Our Evaluation of the ESRC Transformative Research Scheme highlighted cross-overs between sociology and neuroscience, as well as social research methodologies drawing on big data/data science as two examples of such emerging fields: <https://esrc.ukri.org/files/research/research-and-impact-evaluation/esrc-transformative-research-scheme-evaluation/>

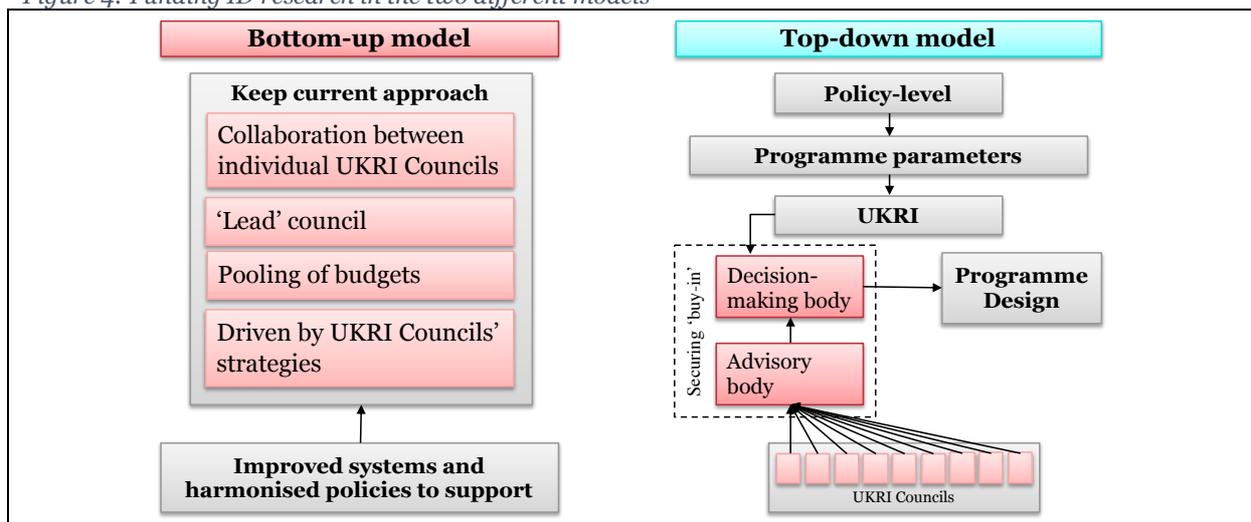
more effective high-level programming, for example in terms of issuing a range of different calls within a single, centrally ‘owned’ programme, e.g. calls focused on basic research and calls for innovation-projects.

However, for centrally organised programmes, there are two potentially conflicting challenges that need to be addressed: on one hand, inter- or multi-disciplinary programmes that are not formulated in consultation with the representatives of specific disciplines or funding areas risk a lack of ‘buy-in’ (i.e. no field of science sees the programme as being for them, so interest and application is lacklustre). On the other, excessive input from the research base risks excessive deliberation and negotiation, and delay.

When creating centrally owned programmes, it is important therefore to have clear processes and guidelines for consultation periods, where representatives of the UKRI Councils (and potentially other relevant members of the research and innovation community) can provide input into the programme aims and scope, but also to have a reliable final decision-making process.

Many funders in Nordic countries make use of advisory councils, which is a model worth considering. Mandatory inclusion of a representative of each UKRI Council would ensure input from across the research and innovation funding base. Yet, a separate entity mandated with taking the UKRI Councils’ feedback into account, but also taking the final decision of programme specification within a set timetable, would help avoid excessive conflict and delay.

Figure 4: Funding ID research in the two different models



3.2.2 Programme, scheme and call design

A standard yet fully flexible tool to design bespoke calls and schemes on-system is very rare among the funders we have considered. The UK national academies’ new FlexiGrant system approaches this type of functionality, and the Australian ARC has a system with such capability, though this has taken significant effort to custom-build.

Funders generally face two challenges: on one hand, a growing need to have more different types of funding schemes and calls to accommodate different missions;⁷ on the other, a need to be more transparent and provide a clear and comprehensible selection of different funding tools, which the community of potential applicants knows and understands.

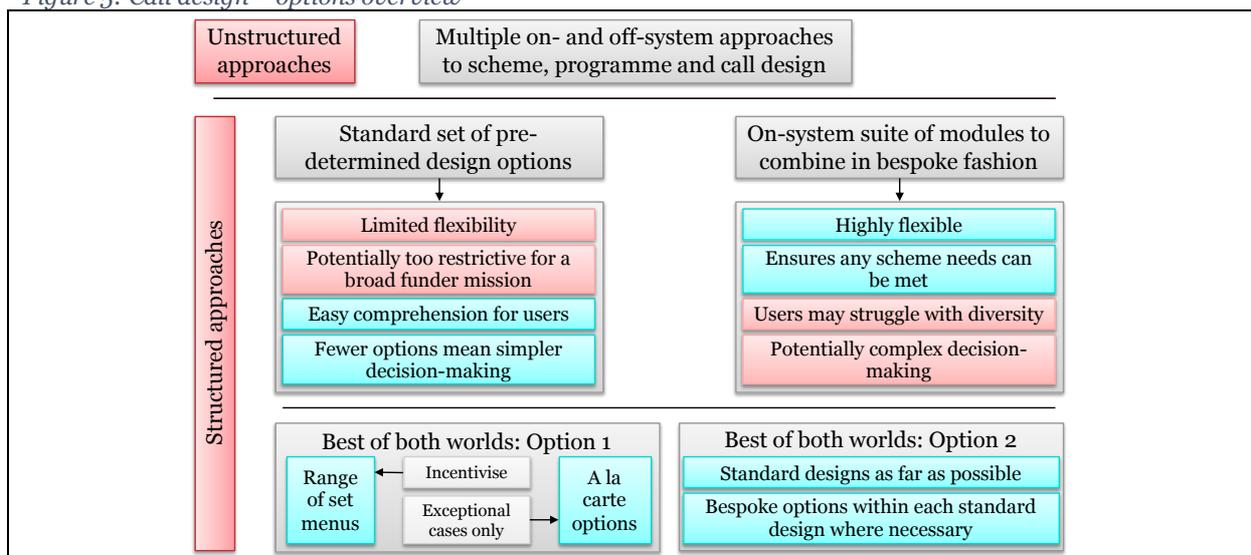
⁷ It is quite common to see the numbers of schemes proliferate over time as funders refine programme types to fit current needs and learn from past experience. This extension of programme variants is also driven top down by policy evolution, and the ambition to find better solutions to new or established challenges and opportunities. Portfolios may be culled from time to time, as was done in the UK in the late 2000s, through the Business Support Simplification Programme and the launch of the Solutions for Business standard menu.

A call design system that allows individual option-selection for application sections, review type, funding criteria, payment type, payment frequency and so on leads to an array of billions of possible scheme designs. This ensures maximum flexibility, but also risks becoming unwieldy and incomprehensible to users of the service. It further imposes the need for decision-making on each individual part of the scheme specification, which risks being a source of extended discussion, disagreement and, therefore, delay, within the funding organisation.

An alternative approach would be to have a set of pre-defined project types, with no further room for modifying specifications. RCN (Norway) takes this approach, using 17 different project types, including types for basic research only, innovation projects and projects for ‘in-between’ stages, as well as doctoral/post-doc funding, centres, research infrastructures, etc. This array covers almost all design needs of RCN. It also allows for simple programming: under a funding programme, a combination of different calls can easily be issued (e.g. under a wider thematic programme, RCN might issue a basic research, a tech transfer and a PhD scholarship call). The ERC has a similar approach. However, innovations in funding calls need to be done off-system (or for RCN through an ‘other’ category), so there is in this sense a degree of rigidity.

Given these limitations, there is a strong case for RIFS to seek a ‘best of both worlds’ approach: standardising call specifications and project types as far as possible, but building flexibilities into the system where the need for a wider range of approaches or scope for innovation may arise. There are two possible options here.

Figure 5: Call design – options overview



- Option 1:** A combination of ‘set menus’ of designs, analogous to RCN’s range of options, combined with an ‘a la carte’ design option for cases where no ‘set menu’ will fit. However, there is a risk here that a great many instances of call design will opt for ‘a la carte’, potentially to the point where there are more ‘a la cartes’ than ‘set menu’ calls (the RCN experience is a case in point). This would result in the kind of hazards outlined above. In such a scenario, it is necessary therefore to also have a mechanism to encourage people to choose from the ‘set menu’ and discourage overuse of the ‘a la carte menu’. For instance, a special request process requiring additional explanation / justification and higher-level approval for an ‘a la carte’ approach would ensure that this is only used for cases where a genuinely promising innovation in R&I funding is necessary. This would preserve a simple and comprehensible array of call types most of the time and minimise excessive deliberation on individual call components
- Option 2:** Partial set menus. The service would include a suite of standard designs (‘set menus’), but these would only be specified up to a point. Once the standardised design has been set, there

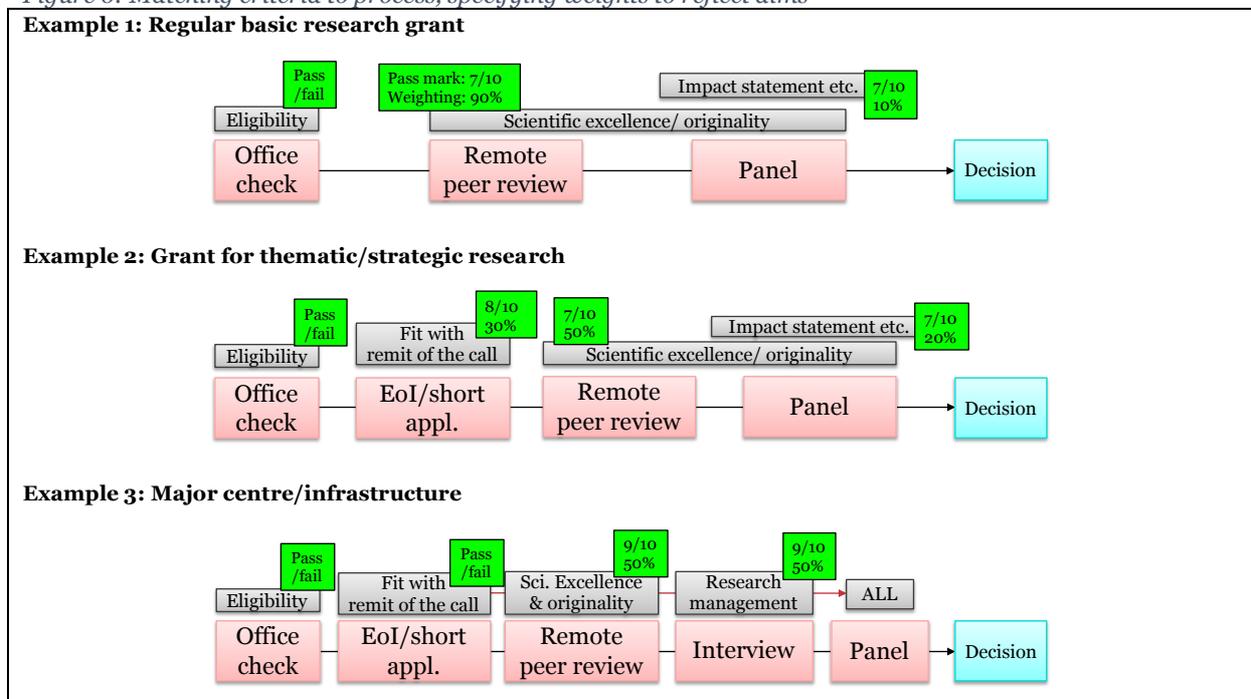
would be certain features that are customisable in all cases. A review of call designs across UKRI may be necessary to determine which features of call design could be standard in all cases, and in what elements further bespoke customisation ought to be feasible. The maximum size of each award might for example be an obvious case where maximum flexibility should be possible within each ‘set menu’, whereas the maximum word/page length per application section might be standard and unalterable for each call type. This approach would ensure a degree of clarity and understanding for applicants, but would allow flexibility at all times where needed.

3.2.2.1 A note on assessment criteria and award mechanisms

R&I funding can take many different shapes, evidenced by the wide array of possible funding tools and call designs that the RIFS will need to be able to offer. It is critical to ensure transparency and coherence when it comes to funding criteria, their respective weight, and how they will be assessed:

- Assessment criteria will typically be determined in part by the strategic purpose of a programme, combined with existing standards and norms at UKRI or UKRI Council level. In the case of each call, the criteria and their respective weight (and/or minimum thresholds) need to be made clear to applicants, in order to help guide their application efforts and to avoid excessive contestation or complaints of unfair treatment
- Where multiple sets of criteria exist in a single call (e.g. scientific excellence, relevance to the mission/challenge/ strategic priority in question, scope for non-academic impact), it is critical for the assessment process to include divisions of labour: which criteria will be assessed by whom or at what stage of the assessment process, and what aspects of the application materials should consequently be considered (i.e. visible to reviewers) at each step?
 - Emphasising such divisions of labour can help avoid duplication of efforts: if for example a user panel is tasked with judging scope for impact, while remote academic reviewers are tasked with judging scientific excellence, each group only needs to see certain parts of each applications. Further, the two processes could take place simultaneously, thereby saving time.

Figure 6: Matching criteria to process, specifying weights to reflect aims



3.2.3 IT systems

The research and innovation funding service needs to be underpinned by a flexible, future-proof, user-friendly and interoperable IT system. Our consultations indicate that this is one of the most critical areas where reform of the present system is needed, especially given that the current Siebel/Je-s system used by the research councils is quite old. Our consultations suggest there is a wide range of restrictive features and rigid automated functions that render it sub-optimal. We also understand that the age of the system means updates are being phased out, so a major overhaul of the current system is not feasible.

Considering an entirely new IT system is one option for consideration. However, InnovateUK has a relatively new system, IFS. At present, this system appears only to cover the ‘front-end’ of the system needs, i.e. the application stage, but we understand that IFS is to be expanded to also include modules for monitoring of awarded projects.

As such, there are two options: either to invest in a fully new system to cover all UKRI councils, or for all UKRI Councils to join InnovateUK on the IFS system, once all further necessary modules have been added.

A new system could be custom-built, and this has been the case for many funders historically. The Australian ARC is a leading example of a funder with a custom built grants management system, completed in 2014, with many functions that would satisfy UKRI. However, building the system was a major 4-year undertaking and requires significant on-site staff to maintain and update.

In recent years, there has been a growing supply of off-the-shelf grants management systems. Most are only suitable for very small funders, but most recently there are options that may suit large organisations with complex operations, as is the case with UKRI. We note these examples shortly.

Nevertheless, there is a case for considering first whether IFS, pending extensions and updates, might be suitable to provide the IT infrastructure for all parts of UKRI in future.

Based on our knowledge of research information and grant management systems, we drew up a ‘checklist’ of considerations and characteristics that an IT system capable of meeting UKRI’s needs would need to have. Whether the option of using IFS across all UKRI Councils is viable depends on whether it will fulfil them. More broadly, any future-proof system (off-the-shelf or designed in-house) would need to comply with the following:

- Past background work by Jisc and RCUK supported the conclusion that CERIF (Common European Research Information Format) should be the basis for the exchange of research information in the UK,⁸ and Gateway to Research has been the perfect showcase of the value of pooling grant information from the UKRI Councils in such an open and reusable format.⁹ The use of an open standard as the backbone for the data model underlying research information contained in the system is an important feature to ensure that such a system can be scaled, improved and linked to other relevant Research Information Systems in the future. Additionally, this provision ensures that there is no lock-in of the data to a specific bespoke solution or service provider, allowing an easier export or migration of the data across systems should there be such a need
- The new system should be developed with Open Access and Open Science principles in mind. From the data perspective, a key consequence of these is that the system should natively accommodate the use of open-source persistent identifiers for the main entities in the data model (awards or grants, scientific outputs, organisations, researchers and other people involved, etc.).¹⁰ This should be accompanied by active engagement of UKRI in the main discussions and decision bodies that promote such standard identifiers

⁸ UKOLN (2010). Research Information Management in the UK: CERIF and metadata alignment.

⁹ Jisc and RCUK (2015). Overview of Systems Interoperability Project Report to the RCUK Research Funding Programme Board.

¹⁰ A weakness often observed is that funding agencies do not always capture data on project partners within one cooperative project and instead only focus on the project leader. Capturing data on all involved parties is important for evaluation, portfolio analysis and, as a consequence, for strategic development of the funding policy.

- The new system will necessarily need to strike a balance between being compliant with enhanced data protection regulations (i.e. GDPR) and the need for data sharing with external organisations providing audit, monitoring and evaluation services or activities. From this point of view, it would be recommended that a set of pre-approved models or template data sharing agreements are put in place, together with a streamlined process to support different levels of external access to parts of the system. This would allow such tasks to be carried out without unnecessary duplication of work and friction, while protecting the rights of data subjects in the system. Some interesting models for managed external data access are offered by the ONS's Virtual Microdata Laboratory (VML), the UK Data Service Lab, HMRC's datalab and by HESA's Heidi Plus platform. These same principles can be applied to parts of the research assessment process (e.g. reviewing proposals and researcher profiles for grant applications). Managing the degree to which the IT system supports these natively will influence the efficiency of these and the move to paperless processes
- Keeping the data updated with outputs and outcomes of concluded projects is one of the challenges that most funders face. Even if grant holders are required to provide updates at set times after a grant concludes there is inconsistent coverage across grant types and funding programmes. This is a matter of incentives, and of minimising the researchers' administrative burden. New data linking initiatives have started to emerge to link publication output to funding by submitting metadata (e.g. ORCID or CrossRef funder registry) and we would recommend the RIFS to intensify this
 - Soft incentives that could be implemented to improve response at the Research Information System level could be to offer some sort of 'gamified' response to grants where researchers have been logging outcomes (for example, by featuring them more prominently in the outward facing websites of Gateway to Research and UKRI).

Aside from being user-friendly, modern and functional, the IT system to underpin the RIFS also needs to:

- Be interoperable with other data sources (e.g. institutional-level systems, other funders' grant information systems, patent and publication databases like Web of Science or Scopus, ORCID), so that duplication of data entry efforts are minimised, and automated harvesting of data relevant to monitoring and evaluation efforts is facilitated
- Be suitable for processing, reviewing and monitoring a broad range of different awards (e.g. standard response mode research grants, fellowships, 'top-down' challenge/mission-driven awards, innovation-related grants and loans, etc.).

No existing system in the examples we have studied is likely to fully satisfy the needs of UKRI, especially as many funders are engaged in constant updating and revising of their systems, to suit evolving technological possibilities on one hand, and changing policy needs on the other. However, there are several examples worth highlighting, which constitute current best practice, and which can provide guidance to UKRI:

- In Canada, the provincial health governments are looking to develop new research management systems¹¹ and the National Research Councils' (NRC) current national plan 2017-18 suggests it is working on a review of its IT systems and business processes for grant management, together with NRC's central services directorate.¹² Some of the NRCs are also flagging plans to update their online systems in the coming year.¹³ The Canadian government's 2018 budget includes two chapters on science and innovation, which makes a passing reference to the need for modernisation of the funding system in terms of its interconnectedness across funders and its ICT infrastructure. This suggests that the Canadian funders are going through a similar process of modernisation.¹⁴ The Canadian innovation agency Innovation Canada (CFI) also has its own online system for application

¹¹ <https://www.csdcsystems.com/project/ministry-alberta-health-grants-management-system-live/>

¹² https://www.nrc-cnrc.gc.ca/eng/reports/2017_2018/dp.html

¹³ (page 4) http://www.nserc-crsng.gc.ca/NSERC-CRSNG/Reports-Rapports/DP/2017-2018/docs/DP-PM_eng.pdf

¹⁴ <https://www.budget.gc.ca/2018/docs/plan/budget-2018-en.pdf>

and grants management, named CAMS.¹⁵ Research institutions can apply for CFI funding and manage pre- and post-award activities using the CAMS system. The system has different accesses for researchers, institutional administrators, and reviewers assigned to assess the proposals

- In Australia, a new system for research grants management (RMS) was introduced at ARC in 2014. The system allows researchers to apply for grants, include publications to their RMS CVs, and participate in grant peer review processes, amongst other things. The system has many innovative features, including scheme design from scratch (which over time evolved into an established set of templates, though more could be created), automated scanning for conflicts of interest for remote reviewers, and reviewer selection based on text-mining of past applications (i.e. creating word-clouds for each past application, and doing so for new ones, enabling selection of reviewers based on past association of certain key word combinations with certain reviewers). A training programme and user guides are available from the RGMS website¹⁶
- Cancer Research UK (CRUK) currently uses a heavily customised version of the easygrants system, but are transitioning to a more modern off-the-shelf solution. The current system covers all the major grant lifecycle management tasks, from submissions of applications, peer review, funding committee review, decision, tracking management and integration with financial systems via monthly exports. Medical research funders need CMS-like functionality in the system for organising the peer review process. Just last year CRUK invited around 5,000 reviewers and a system is necessary to keep track of this process. An area that is not well covered by the current solution is that of reporting of outcomes, operational KPIs and providing useful information for evaluation purposes. This is one of the main reasons for the update. The current system relied on heavy customisation with regards to data warehousing and reporting, and the integration with the grants management system was not as seamless as it had been anticipated. The new system will be built with ORCID integration, so that publication information can be tracked, reducing the burden for grant applicants. This same ORCID integration will facilitate research tracking over long timeframes, for example by being able to track what researchers who were funded in their early careers are publishing now
- The Royal Society¹⁷ and the other UK national academies have started using the FlexiGrant system, which went live in April 2017. The FlexiGrant system is developed by the company Fluent. Lloyds register foundation and other smaller charities and trusts are also using the system to manage their grants. The FlexiGrant system replaces the old e-gap system that the Academies had since 2003. E-gap was mainly a custom-built system, developed in partnership with the Royal Society. Overall, that system was no longer meeting the needs of the funder due to an expanding portfolio, so a new system was commissioned. The FlexiGrant system was found to meet around 2/3 of the requirements out of the box, and customisation has been carried out in the peer review workflow and document portal in order to make it more fit for purpose. The FlexiGrant system is currently being evaluated live, and reviewers are being surveyed on the ease of use of the system. The system is fairly intuitive in terms of maintenance so a lot can be tweaked from the funder's accounts. However there is also a support desk, and maintenance from the developer side has relatively short downtime of the system. A good relationship has developed between the funders and the system developers
- The Swedish Research Council also provides information about grants, researchers and organisations through the Swedish national CRIS SweCRIS.¹⁸ This new system also integrates the data of 11 other funders across Sweden

¹⁵ <https://innovation.ca/apply-manage-awards/apply-funding/cams>

¹⁶ https://www.nhmrc.gov.au/files_nhmrc/file/grants/rgms/rgms_user_guide_-_introduction_to_rgms_research_community.pdf

¹⁷ <https://royalsociety.org/grants-schemes-awards/grants/flexi-grant/>

¹⁸ <https://www.swecris.se/about/#contentfront>

- The system shortly to become operational at FWF (Austria) will capture comprehensive information on the use of research equipment and final report data including outputs, outcomes and follow-up funding, in a system of logged outcomes similar to ResearchFish
- The Swiss SNF's P3 system uses an internal system of unique numerical identifiers for applicants and awards, allowing cross-analysis between these two categories. However, P3 also allows users to enter their ORCID ID into their applicant's profile, which in turn allows the user to import their outputs/publications data more easily. This dual use of internal SNF identifiers (mandatory) and ORCID (optional, for now), may help to enable a smooth transition to a possible future scenario where all researchers use ORCID
- The Gateway to Research itself, with its external facing API access is a good test case of promoting re-usability of the data. Over the past two years it has become a vital piece of infrastructure to support the discovery and analysis of information on research and innovation funding in the UK.

All these recommendations and examples are aimed to propose an IT system that addresses the needs of its users and supports more efficient research funding and management processes, while protecting the integrity of the information and the rights of data subjects.

As a final recommendation, while the progress towards a system that ticks all of these boxes will undoubtedly be challenging, involved parties should resist the temptation of going off-system during this transition. Usually, technical solutions of this nature improve non-linearly the more battle-tested they are. While on the surface some of these items could be more easily managed by existing ad-hoc approaches, this would break the feedback necessary to improve the system going forward. As a result, an agile governance to deploy and manage changes to the system going forward is as important as the system itself.

3.2.3.1 Grants management systems – implications for UKRI

Generally, information on the Current Research Information Systems (CRIS) that are built by research funders around the world is more readily available than information on the grant management systems used to administer and manage the funding.

Over the past decade, many different vendors have emerged providing turnkey solutions for grants management. Many of these are usually the product of small vendors in the US and their main target clients are private foundations and trusts, town or city councils, and small agencies. Usually these products are offered as simple cloud-based solutions at the lowest tiers, although some of them can scale to on-premises bespoke developments with capacity for unlimited numbers of programmes and users in the system. Conversations with grant management systems administrators in other UK funders have revealed that many of these systems are not yet fit for purpose as they are either too rigid or lack functions for pre- to post-award management, only allowing part of the funding process to be on-system. In terms of cloud-based systems based in the US there is also a question around compliance and the location of data storage.

However, systems that can scale and be customised include CC Technology grant tracker¹⁹ (used by the Wellcome trust), FlexiGrant²⁰ by Fluid and Aims²¹ by Quest. These are in operation at various major funders and it is certainly worth assessing whether they could scale yet further up to complexity of operations at UKRI.

Usually, the technical requirements laid out in detail will allow narrowing down into a subset of these potential vendors. The system should not be regarded as a mere grant management system with some additional features, but rather as an agency IT system supporting all agency activities. For a funder at the scale and complexity of UKRI it would be sensible to establish the following minimum key aspects:

¹⁹ <https://www.cctechnology.com/cc-grant-tracker/>

²⁰ <https://www.flexigrant.com/>

²¹ <http://grantmanagementsoftware.com/>

- An on-premises system or at least a system within the UK (for data protection issues and to minimise downtime)
- UKRI should have the ability to directly maintain and administer the system (to avoid vendor lock-ins)²²
- The system should allow for bespoke grant management workflows and to capture custom fields in the main entities (awards, people, etc.)
- The system should have the ability to store open persistent identifiers and should be ‘pluggable’ to other services, in order to leverage data that is already in other systems and to minimise unnecessary burden and duplication.

3.2.4 Peer review

A modern peer review system needs to contend with two distinct challenges:

1. The increasing burden of peer reviewing work on the research community (and indeed on the back-offices of funders). Excessive reviewing duties prevent researchers from conducting their actual research work, and may also impact on response rates from reviewers
2. The increasing diversity of funding tools and aims of R&I funding, which require greater diversity of funding criteria (e.g. impact, relevance to a mission/challenge), of reviewer types (e.g. research users, policymakers), and of reviewing techniques.

Innovations in application reviewing tend not to address both of these issues. As such, it is critical for the RIFS to include a balance of measures sensitive to both.

To ease the burden especially on **remote peer review**, the RIFS would benefit from incorporating the following steps:

- The IT system to be used for remote reviewing needs to be as simple and user-friendly as possible, allowing reviewers, for example, to start and stop a review at any point and sign in from a number of different devices, rather than demanding a review be completed start-to-finish in a single session
- Some funders (like the Swiss SNF) place limitations on how many awards any individual applicant is allowed to hold simultaneously (two in the case of SNF). This prevents applicants from submitting excessive numbers of (potentially sub-standard) applications in quick succession and encourages focus on submitting a single (potentially more high-quality) one instead, easing the overall peer review burden. Other funders allow only one application per individual per call as PI, with no limits on the total awards an individual can hold.
 - This most often applies to the ‘response mode’ equivalent (e.g. RCN). Exempting other schemes from such limitations may also present a useful tool for demand management, although such an approach does not appear to have been taken anywhere so far
- Alternatively, or in addition to multiple stages of remote peer review, an expression of interest or intention to submit stage using simple eligibility criteria could be used to both gauge interest and limit the amount of outline/full applications going to remote review. This is usually done by the funder’s office for large scale grants. In the case of some Global Challenges Research Fund (GCRF) calls in the UK, this stage is useful to check Overseas Development Assistance (ODA) eligibility. It is important to note here that office staff must have the appropriate knowledge and training to be effective at using this method of demand management effectively
- A user-friendly reviewing system also needs to ensure that reviewers only see those parts of the application that are relevant to their reviewing duties. Applications should be ‘sectioned’ in such a way that, for example, administrative information is not shown to the reviewer

²² We refer to software applications. Hardware may be a different matter and is indeed often outsourced.

- Turnover of peer reviewers is a significant issue across international funders and will require careful management to ensure the RIFS has high quality reviewers that are available and skilled in the assessment systems used. Peer review colleges have been a useful tool employed by other funders which also incorporate a high number of overseas reviewers, which appears to have kept their membership more stable. NIH maintains small core panels across their 180 study sections and recruit externally only when necessary, this has worked well as part of a two-stage system whereupon applications are then scored by research institute review branches. Annual or less frequent membership reviews will ensure members are kept informed of the assessment system and provide RIFS with the opportunity to reassess the expertise within their roster. Importantly, some modern grants management systems allow funders to track response rates from reviewers, and this intelligence can be used to select reviewers with a proven track record of higher responses. The ARC's system goes further, allowing automated identification of best reviewers based on text mining of past applications
- Whilst financial compensation for remote reviewing is un-realistic, it is worth considering status-based incentives for remote reviewers: public profiles listing, for instance, each reviewer's number of reviews completed, the diversity of schemes or disciplines in which they have reviewed, may prove an incentive to increase response rates and 'buy-in'. Such incentives would be strengthened if HEIs in turn acknowledged the importance of reviewing duties.

Remote peer review is rarely bypassed completely due to its comparative benefits and effectiveness in assuring quality of applications. However, there are some cases where remote review is not always deemed necessary. RIFS may consider similar approaches in comparable cases to further reduce the burden of remote review:

- Business Finland (formerly Tekes) does not use remote peer review, apart from in its FiDiPro programme (scientific quality of the visiting scientist) and in the Young Innovative Enterprise funding scheme (review panel acting in an advisory capacity consists of non-academics: VC investors, business angels, serial entrepreneurs, etc.)
- Although not fully bypassed, only one reviewer is used for small grants (under €30k) implemented at the DFG in Germany, which is then approved by an internal review board (not a bespoke panel convened for that programme)
- 'Personal grants' awarded by the FWO (Belgium/FI) are decided without peer review and instead use pre-reports prepared by two panel members to make decisions
- All grants with a value of under €15k are decided internally by FNR in Luxembourg, typically by the scientific president and CEO (e.g. RESCOM – research communication conferences)
- NIH Director's Pioneer awards are high-risk high-reward grants reviewed by interview only. Although a large volume of applications is received, significant sifting is carried out to cap those sent to interview at 25% of applications. This is not done commonly across the organisation but is useful in this type of award.
- The NSF experimented with by-passing all remote and panel review stages for its Small Grants for Exploratory Research (SGER) awards: applicants directly contacted the programme directors, who could hand out these grants at their discretion, in order to counteract the conservatism associated with peer review and ensure that transformative, radical new directions in science could be funded. Evaluations suggested that funded projects were often successful, but that the tool was under-used, i.e. programme directors rarely committed to funding projects in this way.

While remote peer review constitutes the lion share of the review burden on the research and innovation community as a whole, it tends to have a tightly delineated function: to assess scientific quality, originality and excellence, and report back an opinion (and usually a grade) based on the reviewer's own individual expertise. This is a long-established process in academia and cannot be significantly altered. On the issue of remote reviewing, the emphasis for RIFS needs to be on demand management and creating a user-friendly experience for reviewers that does not compromise the quality of reviewing and consequently the quality of grants funded (as outlined above).

Review panels, by contrast, can fulfil a range of different functions, some of which have only recently become prominent in research and innovation funding. While a user-friendly experience (e.g. in the shape of a paperless, intuitive IT system) is also important here, there is more scope for implementing novel approaches.

Convening panels is costly and time-consuming, so the prospect of remote panels is tempting. However, there are few examples internationally of this happening in practice, not least because the rationale for panels is typically to enable dialogue and consensus-building, potentially between very different viewpoints and stakeholder types.

NIH has used hybrids of physical/remote panels successfully. ‘Videoconferencing’ was the most preferred medium after ‘face-to-face’ in the Centre for Scientific Review’s internal survey. This has worked particularly well for calls that require international reviewers and clinicians and is seen as a suitable approach when the alternative would be organising especially extensive travel for panellists. Reviewer comments have been especially thoughtful when received using an asynchronous web-based method where reviewers leave comments within a timed window (half a day) in an online forum. The RIFS should consider these options along with their feasibility with existing IT infrastructure.

Another option is the Delphi method, used in some cases by the NWO in the Netherlands. The Delphi method is a widely used and accepted method in academic publishing and health research for gathering data from respondents within their domain of expertise. It uses a systematic process of multiple questionnaires and subsequent feedback iteratively to achieve consensus on an issue. It can easily be applied to R&I funding, where reviewers judge upon criteria and confer through resulting feedback over a period of time. Put simply, the process involves the following:

- A programme manager distributes a first round of short questionnaires to a selection of remote reviewers asking them to evaluate the same applications on the same set of criteria. This is relatively open to allow for diversity in these initial comments
- Remote reviewers independently review the applications and return their questionnaires to the programme manager, so far reflecting a typical process of remote review
- The programme manager summarises and edits the comments of the individuals and issues a statement of the position of the whole group and the reviewer’s own position on each application. This is the ‘feedback’ process. This helps to ensure that reviewers are aware of the range of opinions and the reasons underlying those opinions across the group
- The second questionnaire may ask reviewers to rank or itemise applications based upon certain criteria. After which the programme manager repeats their feedback process
- In the third round, reviewers are asked to justify why any of their choices remain outside the current consensus – if significantly incommensurable from the others. The feedback process repeats
- In the final round, remaining items, their ratings, minority opinions, and rankings achieving consensus are distributed to the reviewers to offer a final opportunity to revise their review or finalise certain decisions. After this, a final ranking is agreed, and consensus is reached.

The Delphi method is resource-intensive and therefore unlikely to ever be a frequently used approach. However, for large awards with a broad range of distinct assessment criteria, it can be used to substitute for a potentially large array of separate assessment techniques.

It is important to note here that the feedback method is the key ingredient as opposed to the number of assessment stages and that the criteria to be judged upon progressively increase. The process retains the anonymity and independence of remote peer review whilst adding the kind of value that a physical panel might imbue whilst around the table conferring, but without the possible hazards (individual dominance, ‘noise’, negative groupthink). The RIFS may consider this approach as a way to bypass panel review as the method replicates some key aspects of that process.

3.2.4.1 Multiple round reviews

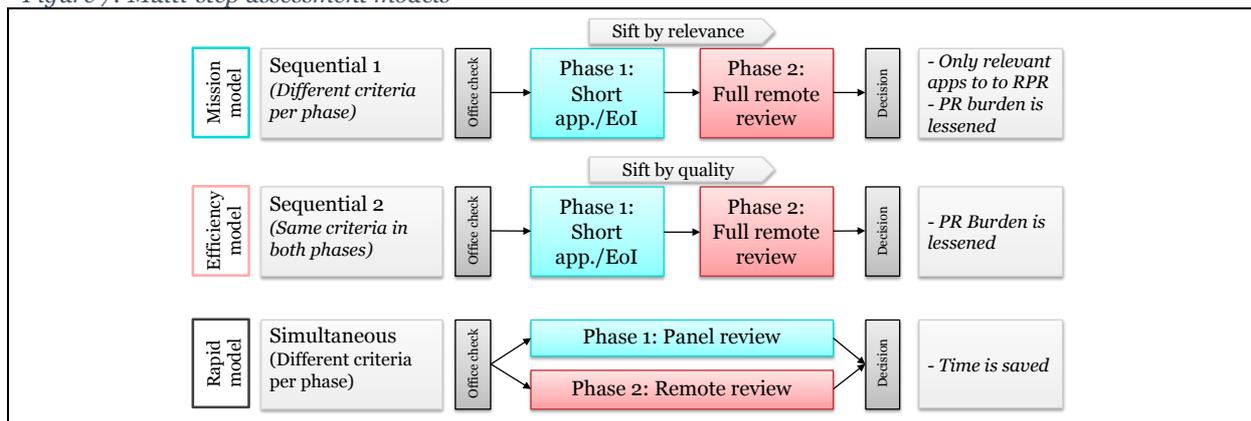
There is a growing trend towards multiple-round reviews, involving a first round of short proposals and a second round of full proposals. Typically, a panel review is involved in both rounds, while remote peer review often happens only in the second. The RIFS should consider including such steps where possible: it firstly reduces the burden of remote peer review on the academic community as a whole (simply because fewer applications reach the remote review stage), and secondly allows for systematic examination of multiple criteria. Applications can, for instance, be scanned at the first stage for fit with the remit of the particular call (e.g. thematic relevance, interdisciplinary nature), before a commitment to in-depth review of scientific merit is made.

A challenge is to find the right balance at the first stage between cost efficiency and speed on one hand, and transparency, credibility and quality of the assessment on the other. If the focus is too much on cost and speed, there is a risk that rejected applicants complain of unfair treatment and the quality of the final set of funded grants may be compromised. However, if the focus is too much on quality, the whole two-stage process may include duplication of efforts, become costly, and take a long time. Instructions to applicants therefore need to be clear regarding what information the short first-stage application should include and what the first-round criteria will be, and the same goes for panellists.

Processes with two or more stages of review typically seek to address more factors than just the scientific merit of projects (other factors might include the potential for impact and the feasibility of the project). As such, it provides additional assurance of the feasibility of the project, which is particularly important for large scale funding that requires strategic management (hubs, centres of excellence).

It is worth clarifying that multi-step assessment models can take at least three main shapes, respectively fulfilling different aims: placing two (or more) steps in sequence can involve either applying the same assessment criteria in each step, in which case the rationale is simply to limit the number of applications going to full remote review in round two (lessening burden). Having different sets of assessment criteria in each round likewise lessens burden, but also allows for division of labour, where the first step sifts out applications on one set of criteria, while step two then reviews the rest, ensuring, for example, that all applications in round two fit the thematic remit of the call (lessening burden & increasing relevance). Finally, the multiple steps can occur simultaneously, which may be useful when rapid response is important in a particular call (saving time), though efficiencies in reviewing effort are lost. In all cases, some form of final panel decision would likely still be necessary.

Figure 7: Multi-step assessment models



Assessment panel interviews are used sparingly as they often occur after a physical or remote panel has convened and thus incur more resource and time. However, they do provide an opportunity to assess the final set of lead applicants on criteria outside of research excellence, typically focusing on elements of project management and how the applicants plan to evaluate their research activities. In a minority of cases, an interview panel is used to bypass remote peer review in fellowship programmes.

3.2.4.2 Assessment techniques: deciding what to do and when

Although the ‘classic’ model involving remote review followed by a panel decision and recommendation still dominates, many additional techniques are also practiced in R&I funding, including in a wide array of different combinations. Table 2 Lists a range of assessment techniques, highlighting that all can be sequenced with others, whilst some are not likely to work as stand-alone assessment techniques.

Given the array of options, there is a risk of consequently creating a vast array of different funding processes and indeed, of potentially selecting sub-optimal tools for a particular call or creating sequences of assessment tools that are more complex than is necessary.

Table 2: Overview of assessment techniques

Assessment type	Use as stand-alone technique (excl. office eligibility check)	Use in combination/sequence with other techniques (excl. office eligibility check)
‘Big Pitch’ events	x	x
Delphi panel	x	x
EoI stage		x
Interview	x	x
Lottery	x	x
Programme manager decision	x	x
Remote peer review		x
Sandpits		x
Short (2-5 page) first-round application		x
User/expert panel	x	x

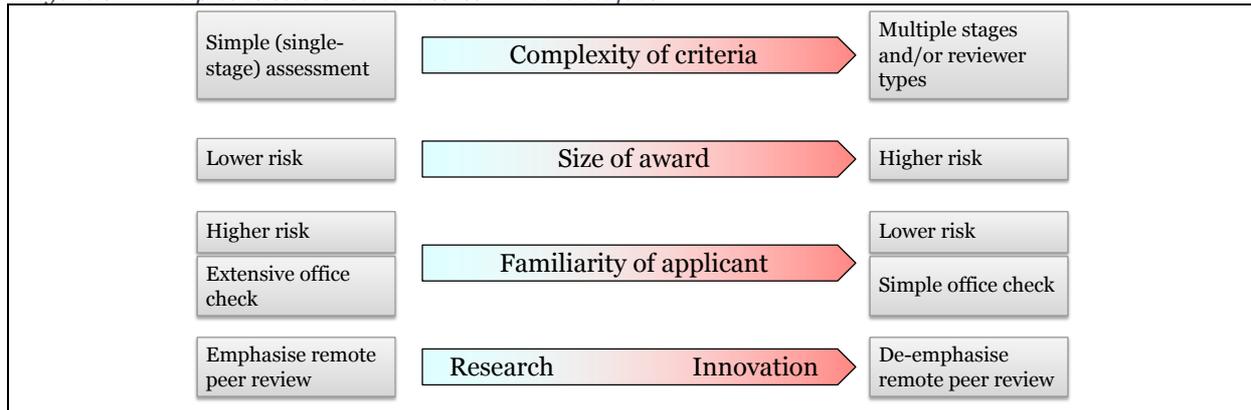
Proposal assessment always aims in various forms to provide risk management. Other matters for consideration are the burden on applicants, the burden on reviewers, implications for time-to-grant, and the quality of the review process and its acceptance by applicants and other stakeholders. However, international practice does not reveal absolute standards in terms of what tools to use for different call types. Yet, there are several tendencies that can act as guidance to the UKRI RIFS:

- The further an award type is removed from pure basic research, the less likely it is that the traditional approach of remote peer review by academics will be a suitable assessment technique
- The more complex the assessment criteria or call aims, the more a multi-step assessment process is likely necessary (e.g. if thematic relevance and scientific excellence need to be assessed, separate rounds to assess for these respectively becomes more preferable)
- In much the same way, inclusion of different reviewer ‘types’ (e.g. academics, users, policymakers) become necessary as criteria and aims become more complex
- Larger awards inherently require greater risk management than smaller awards. As such, larger awards may require more checks and balances (i.e. more assessment steps), while for smaller awards, steps like by-passing remote review, or having a single panel or interview as the sole step becomes more advisable and proportional
- Interviews may be advisable in two specific cases: either when grants involve significant project management, at which point they become an additional assessment step for further scrutiny, or for small awards such as early career initiatives, where an interview becomes the main assessment step, in preference for example to extensive remote reviewing

- The type of applicant institution also has implications for assessment procedures, in particular for the initial eligibility checks: applications for basic research grants by established researchers based at UK universities will likely only require a basic check, which could potentially be automated (as is the case at the ERC). For other awards where applicants may include businesses who are applying for R&I funding for the first time, or where ODA requirements need to be checked, a more elaborate checking process will need to be triggered.

It is critical that these are not viewed as absolute rules. There may be good reason to break some of them in particular cases. However, they provide important parameters to help guide assessment tool selection.

Figure 8: Principles to select review assessment techniques



Finally, it should be noted that experimentation with innovate and potentially un-tested assessment methods should remain possible. It may at certain points be interesting to experiment with the use of possible new approaches. Crowd sourcing is one approach mooted by our expert panel, i.e. recruiting a larger number of identified experts, who could on a voluntary basis vote based on more limited information on a set of applications. Identification would be needed to avoid conflicts of interest and thereby manipulation of the voting result. It could allow commenting or only voting, and applications with the most votes would proceed to further assessment or decision. Other potential new techniques may arise and the RIFS should have the ability to pilot them when and where appropriate.

4 Recommendations

We outline below our recommendations for the RIFS, based on our analysis in each of the four areas under investigation.

4.1 Recommendations on strategy issues and interdisciplinarity

- Several areas of operational and research strategy and policy ought to be fully centralised at UKRI level and be identical for all UKRI Council's activities. This includes equality/diversity, open access requirements, eligibility criteria, compliance issues and financial regulations, and periodic reporting duties for award holders (reflecting of course different reporting duties for different award types). Aside from efficiency savings, this stream-lining will ensure that applicants used to the policies of one particular UKRI Council can apply to another more easily
- Specifying the details of assessment criteria, maximum/minimum grant size and other factors that may be specific to certain disciplinary areas should remain within the remit of the UKRI Councils. The same goes for setting up programmes and schemes that pertain solely to the remit of a single UKRI Council
- Except in cases of 'bottom-up' interdisciplinary endeavours driven by scientific cross-over between specific sets of disciplines (and potentially other 'low-volume' initiatives unlikely to involve most or all councils), multi- and inter-disciplinary thematic (or 'mission'-driven) programmes should generally be located centrally at UKRI-level, rather than having a 'lead council'. A programme delivery team composed of central UKRI staff, supported by an advisory group composed of representatives of all UKRI Councils is one possible model for doing so
- Such programmes need to ensure 'buy-in' from the various disciplinary communities, but also avoid excessive deliberation and delay. It is critical therefore on one hand to have an advisory consultation mechanism that includes representatives of the UKRI Councils and other stakeholders, but to also have a time-tabled decision-making process that is mandated to take such consultations into account (so that the consultations do not get relegated to a 'talking shop'), but is separate from them
- UKRI's parallel ambitions to fund excellent research, achieve research impact, achieve returns on investment, and ensure relevance to designated missions or challenges need to be weighed up at the level of individual funding calls or schemes. Rather than considering a UKRI-wide or UKRI Council-wide prioritisation of any of these aims, the aim and substance of each call should be the prime locus of such prioritising, most notably in the shape of weightings of funding criteria, and how they are assessed.

4.2 Recommendations of call and scheme design

- For a standard yet fully flexible tool to design bespoke calls and schemes on-system, there are two options: either the currently envisaged combination of 'set menus' (i.e. pre-determined call templates) and an 'a la carte' option (creating a fully new call type on-system from scratch), or set menus only, but with flexibility in those aspects of call design where it may be necessary. The former option risks a proliferation of 'a la carte' schemes and calls, leading to a bewildering array of funding tools, so a mechanism to incentivise 'set menu' use is essential. For the latter option, an appraisal would need to be made of what aspects of scheme design (within each 'set menu') genuinely require further degrees of flexibility
- In the case of each call, the criteria and their respective weight (and/or minimum thresholds) need to be made clear to applicants, in order to help guide their application efforts and to avoid excessive contestation or complaints of unfair treatment
- Where multiple sets of criteria exist in a single call (e.g. scientific excellence, relevance to the mission/ challenge/ strategic priority in question, scope for non-academic impact), it is critical to clarify what criteria will be assessed by whom and at what stage of the assessment process. This can help avoid duplication of efforts and also enables different parts of an assessment process to take place simultaneously.

4.3 Recommendations on IT systems

Headline recommendations

- The RIFS needs to be underpinned by a flexible, future-proof, user-friendly and interoperable IT system. Our consultations indicate that this is one of the most critical areas where reform of the present system is needed
- We recommend it should be an on-premises system or at least a system within the UK (for data protection issues and to minimise downtime), and should be easy to update or change over time
- The system should allow for bespoke grant management workflows and to capture custom fields in the main entities (awards, people, etc.)
- The system should have the ability to store open persistent identifiers and should be ‘pluggable’ to other services, in order to leverage data that is already in other systems and to minimise unnecessary burden and duplication
- Full roll-out of IFS as well as purchase of an off-the-shelf grant management system should be considered as options. The final decision on which to opt for could be aided by a conceptual system design, drawing in part on the findings of this report (what would a new system need to be able to do right away? What functionalities should it be able to develop/accommodate in the medium and long-term future?).

Further recommendations

- UKRI should ideally have the ability to directly maintain and administer the system, or have minimal need for vendor supervision
- Making ORCID mandatory for university-based applicants should be considered in the near to medium term future, though working with UKRI-internal unique project and person identifiers may continue to be a requirement as well, particularly as ORCID is not an established tool among many business applicants (though it is among some)
- CERIF (Common European Research Information Format) should be the basis for the exchange of research information in the UK. The use of an open standard as the backbone of the data model underlying research information contained in the system is an important feature to ensure such a system can be scaled, improved and linked to other relevant Research Information Systems in the future
- Additionally, this provision ensures that there is no lock-in of the data to a specific bespoke solution or service provider, allowing an easier export or migration of the data across systems should there be such a need
- The new system should be developed with Open Access and Open Science principles in mind. The system should natively accommodate the use of open-source persistent identifiers for the main entities in the data model (awards or grants, scientific outputs, organisations, researchers and other people involved, etc.)
- We recommend that this should be accompanied by active engagement of the RIFS in the main discussions and decision bodies that promote such standard identifiers
- The new system will need to strike a balance between being compliant with enhanced data protection regulations (i.e. GDPR) and the need for public reporting of data, transparency, and data sharing more broadly with external organisations providing audit, monitoring and evaluation services or activities. A set of pre-approved models or template data sharing agreements should be put in place, together with a streamlined process to support different levels of external access to parts of the system
- Keeping the data updated with outputs and outcomes of concluded projects is one of the challenges that most funders face. This is a matter of incentives, and of minimising the researchers’ administrative burden. New data linking initiatives have started to emerge to link publication output

to funding by submitting metadata (e.g. CrossRef funder registry) and we recommend the RIFS to intensify this

- Soft incentives to improve input rates to the Research Information System could be to offer some sort of ‘gamified’ response to awards where researchers have been logging outcomes (for example, by featuring them more prominently in the outward facing websites of Gateway to Research and UKRI)
- While the progress towards a system that is fully operational and fit-for-purpose in all respects will undoubtedly be challenging, involved parties should resist the temptation of going off-system during this transition. Usually, technical solutions of this nature improve non-linearly the more battle-tested they are. Agile governance to deploy and manage changes to the system going forward is therefore as important as the system itself.

4.4 Recommendations on Peer Review

Headline recommendations

- The ‘classic’ review procedure for research grants is well established and trusted by the academic community: a basic office eligibility check, review by at least two remote reviewers (potentially more, e.g. in the case of inter-disciplinary applications), panel review and ‘ranking’ of applications, funder sign-off on final funding decisions. This approach should remain as the backbone of much of UKRI funding, with several possibilities to make this process more effective, efficient and user-friendly (see detailed recommendations below)
- There is a need to develop guidance on when and how to deviate from the ‘classic’ application review procedure. Factors likely to play a role here are, for example, whether the award pertains more to fundamental research or to innovation, the size of the award, the type of applicant (e.g. UK university researcher, small business or overseas institution), and the breadth of assessment criteria (e.g. the more the criteria for a call extend beyond scientific excellence to aspects like thematic relevance, potential non-academic impact, return on investment, the greater the likely need to go beyond traditional remote review by academics). Other considerations may of course also flow in to such guidance. The aim is to ensure appropriate assessment processes and suitable levels of risk management in all cases.

Further recommendations

- The remote review elements of this process can be made more user friendly and the overall peer review burden on the community lessened by the following steps:
 - The IT system to be used for remote reviewing needs to be as simple and user-friendly as possible, for example by allowing reviewers to start and stop a review at any point and sign in from a number of different devices, rather than demanding a review be completed start-to-finish in a single session
 - A user-friendly reviewing system also needs to ensure that reviewers only see those parts of the application that are relevant to their reviewing duties. What is ‘relevant’ depends in each call on the function of the review component in question. Applications should be ‘sectioned’ in such a way that, for example, administrative information is not shown to the reviewer if the reviewer’s remit is strictly to judge the scientific quality of the research plan. Screening out personal information on the applicant can also be used as a tool to ensure greater equality and diversity (as used in one application stage of the ESRC’s Transformative Research scheme)
 - UKRI should consider placing limitations on how many awards any individual applicant is allowed to hold simultaneously (at least within any one funding scheme). This prevents applicants from submitting excessive numbers of (potentially sub-standard) applications in quick succession
 - Exempting certain schemes from such a limitation may also present a useful tool for demand management, although such an approach does not appear to have been taken anywhere so far

- It is worth considering status-based incentives for remote reviewers: public profiles listing, for instance, each reviewer’s number of reviews completed, the diversity of schemes or disciplines in which they have reviewed, may prove an incentive to increase response rates and ‘buy-in’. There is likely a need in this context for UKRI to communicate to HEIs that the UK research system will become more efficient and effective if peer reviewing would be recognised as part of the academic appraisal system
- Developing the capacity to monitor response rates would almost certainly increase the effectiveness and efficiency of the remote review process
- For small and/or low-risk awards (e.g. travel grants, PhD studentships, innovation vouchers), remote peer review can be by-passed and a panel convened instead. Alternatively, one rather than two remote reviewers is likely sufficient. A third alternative is to award such small sums on the basis of interviews with the applicant depending upon the expected demand. In some cases, decision by programme managers may even be sufficient. Proportionality is encouraged
- When applications are made by established UK research institutions, a relatively minimal office check is required, much of which may even be possible in an automated way. For organisations applying for the first time (or more generally less well-known to the funder), more detailed office/eligibility checks are necessary. A multiple-tier approach to office checks is therefore advisable, where unnecessary scrutiny and administrative burden is avoided, but necessary scrutiny is practiced for less established applicant organisations (e.g. including ODA eligibility where relevant)
- Remote peer review is appropriate for calls that seek to fund scientific excellence and originality. For calls that do not seek to do this (e.g. purely innovation-related awards), remote review may be by-passed and academic/user panels and/or interviews used instead
- There appears to be limited support among the academic community for videoconferencing and similar web-based methods (remote panels). However, there is an opportunity to introduce such approaches in combination with traditional face-to-face panel meetings to accommodate remote colleagues who still wish to participate, saving costs while upholding rigour. The IT infrastructure must be sufficient to support this
- Multi-stage assessment processes:
 - Though they potentially extend the time-to-grant, assessment procedures consisting of more than one review round (e.g. a panel review of short applications, followed by remote peer review) are appropriate in two main scenarios:
 - Where several different sets of criteria need to be judged: different criteria can be judged at separate stages of the assessment process
 - Where the peer review burden is sought to be lessened: only applications that have passed an initial assessment go to full remote peer review in the first place
 - Especially for thematic programmes, fit with the thematic remit can usefully be assessed at the first stage in the shape of a short summary statement (e.g. 2-5 pages), so that only those applications that qualify on this criterion will then compete in a remote review assessment of scientific excellence
 - Expression of interest and outline stages are particularly useful for large complex programmes that are novel to the funding landscape. The additional stages are short and efficiently sift out applications that are not eligible or fit to the call specification
 - If the division of labour (and division of key criteria) between the two (or more) assessment stages is clear, then these stages can also happen simultaneously. This is beneficial in calls that require especially rapid awarding but does not ease the burden on peer review.

4.5 Monitoring and assessing process optimisation

Finally, it is worth laying the foundations for a more systematic approach to process evaluation across the councils as a means by which improve cross-council learning and process optimisation more generally. This may also help UKRI codify more of its deep knowledge, capturing tacit expertise in standard operating procedures. Such a development might consider several parallel and complementary aspects:

- One possible trajectory would be to determine a set of key performance indicators for a ‘successful’ research and innovation funding service (e.g. average time-to-grant, reviewer response rates, % of calls designed fully on-system, % of grant holders with ORCID, % grant holders updating ‘impact’ questions in periodical updates on ResearchFish), which could be tracked and reported periodically by each UKRI Council (to allow local calibration and comment) and by UKRI overall
- Another possible approach could be the institutionalisation of a post-call reflection and lessons-learned review. Commissioning short feedback surveys will also ensure the extent of improvement can be suitably assessed. This could include surveys of remote reviewers and applicants to reflect on the user-friendliness of the reviewing/application process
- It may also be helpful to encourage each of the councils’ evaluation teams to come together to agree how UKRI might best strengthen its approach to process evaluation across the piece, whether that is through the greater use of piloting as an input to the design of new/ novel programmes or a rolling programme of cross-cutting evaluations focusing on particular types of instruments (e.g. fellowships, small grants, CDTs, centres of excellence, etc.)
- The DTI ran a series of cross-product monitoring surveys in the early 2000s, which provided valuable feedback from beneficiaries on a wide range of questions to do with programme design and operations
- There are other conceivable approaches too, such as including a process evaluation component within every ex post evaluation, albeit such a broad approach may be unduly burdensome and may lead to somewhat superficial treatments
- Given the critical role programme managers and operational staff play within a successful research and innovation funding service, it may also be worthwhile monitoring staff satisfaction with organisational culture and systems. Internal staff surveys at UKRI and the UKRI Councils may also be worthwhile (the Civil Service People Survey may contribute useful existing data)
- Critically, such feedback exercises ought to be deployed before, while and after systems are changed, so that progress can be robustly assessed.

Appendix A Background to the study

A.1 Project team & client oversight

Project team at Technopolis:

- Adam Krcal (<http://www.technopolis-group.com/staff/adam-krcal/>)
- Billy Bryan (<http://www.technopolis-group.com/staff/billy-bryan/>)
- Kristine Farla (<http://www.technopolis-group.com/staff/kristine-farla/>)
- Paul Simmonds (Director) (<http://www.technopolis-group.com/staff/paul-simmonds/>)
- Peter Kolarz (Manager) (<http://www.technopolis-group.com/staff/peter-kolarz/>)
- Xavi Potau (<http://www.technopolis-group.com/staff/xavier-potau/>)

A.2 Expert panel

- **Arvid Hallen:** Arvid brings a unique perspective as a former Director General of the Research Council of Norway (RCN), one of the few organisations that presents a genuine success story of a fully joined up research and innovation funding organisation. Arvid has overseen the process of creating RCN in its current form and will provide an especially important perspective not only on the structural features of the organisation, but also on the potential internal conflicts and difficulties that may arise in the task of creating an integrated research and innovation funding service. Funder expertise: RCN (Norway).
- **Elisabeth Zaparucha:** Elisabeth is a Director at the Paris office of Technopolis. Her main fields are innovation, research, technology transfer and higher education policies at regional, national and European levels as well as from an international perspective. She has contributed to the evaluation of major French innovation policies (e.g. the evaluation of the National Cluster Policy, the evaluation of the national competition for the creation of new technology based firms, the evaluation of the Technology Transfer Acceleration Companies - SATT). Funder expertise: ANR / BPI / ADEME / DATAR (France)
- **Erik Arnold:** Erik is co-founder and Chairman of Technopolis Group and Adjunct Professor in research policy at the Royal Institute of Technology (KTH), Stockholm. His work in R&I policy and evaluation spans over 30 countries, the European Commission and a range of international organisations including the OECD, World Bank, Nordic Council of Ministers, ESF and COST. He led much of Technopolis' work on process mapping and benchmarking in R&D funding-programme management as well as leading an internal project in VINNOVA to develop a programme design and management handbook in the early years of that organisation. He is expert in the design, management and implementation of evaluations of research and innovation organisations, programmes and policies and has evaluated the Academy of Finland, Tekes, FWF, FFF (the former Austrian innovation agency), RCN, the Marsden Fund (New Zealand) and the National Natural Sciences Foundation of China. Funder expertise: Swedish Research Council / Vinnova (Sweden), RCN (Norway), TEKES and Academy of Finland, ERC (EU)
- **Geert van der Veen:** Geert is a Technopolis Director in Amsterdam. He has more than 20 years of experience in the field of innovation, science and innovation policy and sustainable development. Within Technopolis Geert is mainly involved in projects related to research and innovation programmes, research organisations and innovation agencies, and projects related to innovation for sustainability. He recently supported NWO in drafting their new strategy. He has also worked at RVO, the Dutch Innovation agency, for over 11 years. Funder expertise: NWO / RVO (Netherlands), VLAIO (Flanders, Belgium), Tekes (Finland).
- **Jari Romanainen:** Jari is a policy advisor at Technopolis and has also worked at Tekes (Finland) in various positions for over 25 years, in recent years at director level. Since 2000, Jari has been

consulting or participating in evaluations related to the design, implementation and analysis of R&D and innovation policies and policy instruments in Estonia, Ireland, Netherlands, Belgium (Flanders), Austria, Sweden, Latvia and Hungary. He has participated in a number of EU level expert groups and evaluations. Funder expertise: Tekes / AcaFi (Finland), EAS (Estonia), LIAA (Latvia), FFG (Austria), VLAIO / FWO (Flanders, Belgium).

- **Katharina Warta:** Katharina is managing director at Technopolis Austria. In the domain of research and innovation policy, her work covers policy and programme evaluations as well as strategy development on the political and the institutional level. Recently, her work has concentrated on programmes of individual funding, e.g., the Alexander von Humboldt foundations' professorship, research award and fellowship programmes, and on the funding of cooperative research schemes, e.g. the Bridge programme of the Austrian Science Fund (FWF) and the Austrian Innovation Promotion Agency (FFG). Funder expertise: FWF / FFG (Austria), DFG / Alexander v Humboldt Foundation (Germany), FNR (Luxembourg).
- **Xavi Potau:** Xavi works on evaluation of public science and innovation policies, with particular interest in data technologies. He is also working on the provision of Analytical Support for the UK Science and Innovation Audits (SIAs) for BEIS. Other recent assignments include the Interim Evaluation of Horizon 2020 Space Research for DG Grow. In previous years, Xavi managed the RecerCaixa programme evaluation for the LaCaixa Foundation. Funder expertise: UK Research Councils, ERC/H2020 (EU), LaCaixa (Catalonia); Research Information systems & associated software.

A.3 Further consultees

To ensure that the internal perspectives at UKRI and its constituent parts are fully integrated into our work, we have consulted several further individuals in the early phase of this study.

Table 3: Additional consultees

Name	Role	Consultation date
Anne Dixon	Operations Director InnovateUK	09/04/2018
Anne Sofield,	Associate director of Programmes AHRC	27/04/2018
Ashley Moore	Head of Analysis RCUK	05/04/2018
Christy Gosden	Head of Grants, Policy and Planning STFC	09/04/2018
Claire Turner	Finance Director NERC	06/04/2018
Gareth MacDonald	Head of Funding Assurance RCUK (hosted by BBSRC)	09/04/2018
Jane Nicholson	Associate Director, Impact & International EPSRC	13/04/2018
Michelle Dodson	Strategic Lead ESRC	10/04/2018
Sarah Collinge	Head of Research Funding Operations MRC	05/04/2018
Wayne Williams	Head of Policy UKRI	10/04/2018

Appendix B Supplementary material

B.1 Raw information from the first evidence call

The following four tables present the abridged input from the expert panel to our first call for evidence. Panellists were instructed to give a brief overview of the practice in the international comparator organisations on each of the four main points of investigation:

- Policy – centre & periphery: organisational structure
- Programming: how to design calls, schemes and programmes, who has input, what is the system?
- IT systems: what systems are used, are they integrated with other sources, what do they collect?
- Peer review: current state of play

Table 4: Expert panel overview data – Policy – centre and periphery

Policy – centre & periphery
<p>Austria – FWF</p> <ul style="list-style-type: none"> • The FWF is organised along three scientific disciplines (Biology and Medical Science; Humanities and Social Sciences; Natural and Technical Sciences). These domains are reflected both in three specialists departments and in the board, as the reporters are listed along these three scientific disciplines and subcategories. • All statutes and policies cover the whole organisation: there are no strategies as such for the individual divisions. There are three strategy departments, concerned with national programmes, international programmes, and policy, evaluation and analysis. • Moreover, there is a staff unit for gender issues and a department strategy-career development, which is organised as a specialised department, as it is also involved in project funding. • Since 1981, both the Assembly of Delegates and the FWF Board were expanded to include representatives of associations and interest groups. Since a more recent reform (2015), the expansion of decision-making bodies adopted in the FOG was essentially reversed, and the FWF was equipped with new structures and its strategic and operational units were separated. Since those reforms, the activities of the FWF have been overseen by a supervisory board. • The FWF has an executive board, a supervisory board, the Assembly of Delegates and the FWF board, consisting of the executive board and the reporters of the FWF, and responsible for deciding on funding for research projects.
<p>Belgium/FL – FWO</p> <ul style="list-style-type: none"> • The FWO is structured around 30 topical expert panels and one interdisciplinary panel²³. Most panels are composed of 16 members majority of which are non-Flemish. The panels evaluate applications. They also meet twice a year to give advice to FWO. The expert panels are divided into 5 scientific domains (Biological Sciences, Humanities, Medical Sciences, Social Sciences, Science and Technology). The interdisciplinary panel evaluates applications of true interdisciplinary nature and if necessary can ask further evaluation support from the topical expert panels. In addition to these, FWO has separate panels for specific purposes or programmes (two SBO Programme panels, International Collaboration panel, Research Infrastructure panel). FWO also has 5 advisory commissions (Big Science, Educational Research for Policy and Practice, Clinical Fellowships, Expert Panel Appointments, Brain Gain). • The highest decision-making body at FWO is the Board of Trustees. The Secretary General is responsible for Strategy and Policy Cell, International Affairs, and Communication²⁴. Director of Operational Management is responsible for Applications and On-going Projects, ICT, Personnel, Finances, Legal Affairs and Logistics²⁵. The Applications and On-going Projects is divided into 8 files (Biological Sciences, Medical Sciences, Humanities, Social Sciences, Science and Technology, Interdisciplinary Research, International Mobility and Excellence of Science), which correspond to the main expert panel structure. The Strategy and Policy Cell is divided according to activities (Fundamental Research, Strategic Basic Research, Scientific Prizes, Research Infrastructure, European Programmes).

²³ <http://www.fwo.be/en/the-fwo/organisation/fwo-expertpanels/>

²⁴ <http://www.fwo.be/en/contact/administration/general-management/>

²⁵ <http://www.fwo.be/en/contact/administration/operational-management/>

- The same general statutes and policies cover all FWO activities²⁶. However, each activity and programme have their own additional programme specific regulations²⁷. These programme specific regulations often focus on rules concerning eligibility (applicants, applications, costs, activities, etc.), monitoring and evaluation requirements, and selected programme specific features.
- FWO follows a ‘research council’ model, where the 30 Topical, 1 Interdisciplinary and 4 other Expert Panels evaluate proposals. The Panels are supported by FWO staff divided into 8 files well aligned with the 5 scientific domains into which the 30 Panels are divided. Depending on the specific programme or call, further support may be offered by the Strategy and Policy Cell²⁸. Each of the councils evaluate the applications and make a proposal to allocate the funding. The eventual funding decision is taken by the Board of Trustees²⁹. All Panels follow the same general as well as programme specific principles and criteria.

EU – ERC

- The calls of the ERC, which are issued once a year, are extremely competitive and do not have any kind of quotas by country or scientific field. Scientific excellence based on peer review is their only selection criteria.
- The ERC follows a bottom-up approach that is driven by the principal investigators with the rationale of providing a level playing field for research across Europe and other supporting countries, independent of political, geographic or economic considerations.
- Although collaborations are welcome, they are not a prerequisite.
- The calls are open to researchers around the world as long as they develop most of their activity in Europe.
- Another differentiating characteristic of the ERC grants is their flexibility, allowing for significant changes on how the budget is spent when the project is ongoing and allowing the researcher to move from institution and country taking their grant with them from one place to another (“the money follows the researcher”).
- The ERC encourages big thinking and tries to avoid restrictions on researchers in their pursue of frontiers of knowledge.

Finland – AcaFi

- The Academy of Finland is structured around 4 research councils³⁰ (Biosciences and Environment, Culture and Society, Natural Sciences and Engineering, Health). There is also a fifth council for Strategic Research, which operates separately from the main 4 research councils. In addition to these, Academy of Finland also houses the Finnish Research Infrastructure Committee.
- The internal divisions of the Academy of Finland follow the main 4 councils, plus two separate Units for Programmes and Strategic Research. These are supported by 5 further units (Planning and Management Support, Administration, Finance, Information Management, Communications).
- In addition to these main divisions, the board of Academy of Finland has appointed 9 subcommittees as independent decision-making bodies for specific programmes (Flagship, General, Radiation Detectors for Health, Safety and Security, Arctic, BioFuture2025, FinSynBio, Health from Science, New Energy, pHealth). These will be operational at least until a new board is appointed.
- The same statutes and policies cover the main 4 research councils, but they each have more detailed council specific funding criteria and policies. Strategic Research Council and the Finnish Research Infrastructure Committee both operate under their own statutes and policies.
- Academy of Finland follows the fundamental model of a ‘research council’, where each of the main 4 councils have a chair and 10 highly respected academic members. These councils are supported by a unit of Academy of Finland staff experts. Each of the councils have independent decision- making rights within the common principles and criteria.
- The Strategic Research Council differs significantly from the main 4 research councils³¹. Its thematic priorities are decided annually by the government (other research councils are independent in this respect), it is by nature cross-disciplinary (each project must be implemented by at least 3 research teams representing at least 3 different disciplines), and each funded project must include serious interaction with society or societal actors.
- The activities of the Finnish Research Infrastructure Committee are based on the national research infrastructure roadmap, which it also is responsible for updating and monitoring.

²⁶ <http://www.fwo.be/en/general-regulations/>

²⁷ see e.g. <http://www.fwo.be/en/fellowships-funding/research-projects/big-science-projects/regulations-for-big-science-programme-projects/> or <http://www.fwo.be/en/fellowships-funding/research-projects/research-project/regulations-for-research-projects/>

²⁸ e.g. the SBO programme panel is supported by the Strategic Basic Research team.

²⁹ <http://www.fwo.be/en/the-fwo/organisation/governing-bodies/board-of-trustees/composition-of-the-board-of-trustees/>

³⁰ From the beginning of 2019 there will be only 3 research councils (Biosciences, Health and the Environment, Culture and Society, Natural Sciences and Engineering), see http://www.aka.fi/globalassets/4oakatemia/ptk-7-liite-1-toimikuntien-toimialat-2019-alkaen_en_final.pdf

³¹ see e.g. <http://www.aka.fi/en/strategic-research-funding/src-in-brief/> and <http://www.aka.fi/en/strategic-research-funding/funding-principles/>

<p>France – ANR</p> <ul style="list-style-type: none"> • The French National Research Agency (ANR) was created in 2005. In 2016, the ANR budget for operation is €595.9m (€728.5m in 2011) that is to say is a very small part of the total public funding for public research in France³². the ANR influence on the research strategy of French public research organisations (PROs) is therefore very limited. • Within ANR, there are three divisions of which one, the Scientific Operations Division, has five thematic departments (Digital Technology and Mathematics Dpt, Physics, Engineering, Chemistry, Energy Dpt., Biology and Health Dpt., Social Sciences and Humanities Dpt. Environment, Biological Resources and Ecosystems Dpt.). The two other divisions are the Grant Agreement and Funding Division and the State Investment Programmes Division. This last division manages specific State fund (Investment for the Future Programme funds) which are distinct from traditional ANR operational budget. • The funding activity of ANR is embedded in an annual work programme (WP) which sets out the ANR research priorities associated with funding instruments. The WP is divided into four cross-disciplinary components, each with its own budget. Each component has funding instruments, calls for proposals and special programmes³³.
<p>Germany – DFG</p> <ul style="list-style-type: none"> • The Joint Committee is responsible for the financial support for research provided by the DFG. It is the DFG's main decision-making body. It bases its final research-policy decisions that relate to the DFG on resolutions passed by the Senate. These especially pertain to decisions regarding the DFG's budget and the general development of its funding policy. The Joint Committee decides on the implementation of new funding programmes and on modifications to existing funding instruments. In addition, it makes the funding decisions various programmes managed by the DFG. • The Joint Committee is made up of 39 members of the Senate, representatives from the federal government (with a total of 16 votes), 16 representatives from the federal states and 2 representatives from the Donors' Association for the Promotion of Sciences and the Humanities in Germany. It works with 7 sub-committees. • The Head office in Bonn employs 750 persons and is structured into four departments (Central Administration, International Affairs and Integrative Activities, Scientific Affairs, and Coordinated Programmes and Infrastructure) and an executive level. The department for Scientific Affairs has again 9 units: Humanities and Social Sciences 1 & 2, Life Sciences 1, 2 & 3, Physics & Mathematics, Geosciences, Chemistry and Engineering Sciences 2, Engineering Sciences 1.
<p>Luxembourg – FNR</p> <ul style="list-style-type: none"> • The FNR is a public institution created by statute (Law of 31 May, 1999) and enjoys legal capacity and full administrative and financial autonomy. Our overall strategy is laid down in a 4-year contract with the Luxembourg Government, which also defines our budget appropriation. • The Executive Office is composed of more than 25 collaborators organised in 8 units: Innovation programmes, Thematic research programmes, Strategic research programmes, Science in society, Talent attraction and capacity building, plus head of finance and a head of international relations. • The Secretary general of the FNR is the chief executive of the organisation. He heads the Executive Office, implements the strategy, oversees programme development and manages all running activities. He is appointed by the Board of the FNR, subject to approval from the government. • A strategy process has been conducted, involving the entire staff and the board members, results were presented in March 2018 (link). • Maintaining the focus on excellent research, FNR is at the same time deepening its engagement in more recent programmes addressing cooperation, knowledge transfer and prototyping. • There is room for innovation in Luxembourg due to generous funding possibilities.
<p>Netherlands – NWO</p> <ul style="list-style-type: none"> • NWO is divided into three thematic domains (Social Sciences and Humanities; Sciences; Applied and Engineering Sciences) and closely collaborates with The Netherlands Organisation for Health Research and Development, ZonMw. Furthermore, nine research institutes governed by the Netherlands Foundation of Scientific Research Institutes (NWO-I) are part of NWO as well. • A recent reorganisation combined eight different areas (of which one, Technical Sciences, used to be a separate research council) into the three domains in 2017 and brought the institutes from 3 organisations into NWO-I. Clustering the areas seemed a necessary condition for working towards more efficiency and transparency of instruments and procedures.

³² In 2014, resources for all public research (whether carried out internally by institutions or subcontracted to external organisations) totalled €19.1 billion. contractual resources' (including contracts, agreements and calls for proposals) accounted for 23% (€4.4 billion) of funding for public research in France in 2014. Latest data available, 2017 Higher education and research in France, Facts and Figures, https://publication.enseignementsup-recherche.gouv.fr/eesr/10EN/EESR10EN_R_30-funding_for_public_research_and_development.php

³³ Within the first component, there are 36 research themes presented in the framework of the nine societal challenges. 8 research themes are cross-disciplinary challenges at the crossroads of several challenges ("Interchallenge" themes).

- Until recently it was considered that ZonMw would merge with NWO too. However, as ZonMw is funded by the Dutch Ministry of Health, it proved too difficult to integrate ZonMw as a fourth domain and ZonMw remains a separate organisation.
- The executive board of NWO carries final responsibility for the entire, umbrella organisation. It consists of a president, vice president, chief financial officer and the four chairs of the NWO domains and ZonMw.
- Each of the domains has a separate board, consisting of national scientific leaders in the domains (and sometimes other stakeholders, e.g. in case of technical sciences business leaders).

Norway – RCN

- RCN has four line divisions and an administrative division, all reporting to the director and his staff. Each line division has a board comprising stakeholders, which in turn reports to the RCN board (stakeholders). The RCN board sets overall strategy and policy (informed by government policy) and takes decisions involving large sums of money. To some degree, it overlaps with the division boards, which set divisional strategies and policies.
- RCN is a multi-principal agency 'owned by the education and research ministry but spending funds from 14 other ministries in addition. Under the 'sector principle', all ministries are required to have research strategies and to spend money on research. They choose how much of that to spend via RCN. Education, Petroleum and Energy and industry spend most via RCN. Health and welfare spends perhaps 10% via RCN and the rest through the regional health authorities (university hospitals) and institutes like the Public Health Institute.
- Ministries allocate budget to RCN through annual 'allocation letters', which instruct RCN how to use the money – based on RCN's budget proposals to each ministry and dialogue between the ministries and RCN. Crudely, the big-spending ministries (education and industry) place few detailed conditions on the money (but broader priorities), while the small spenders tend to earmark funds in more detail. A key RCN function is to design multi-ministry programmes (eg climate), allowing it to address horizontal issues like the societal challenges while simplifying the programme portfolio (which has been very complex).
- RCN was formed in 1993 by merging four research councils and an innovation agency. This was government's response to the failure of the previous system to implement properly a set of cross-agency thematic priorities (ICT, biotech, management etc). But these organisations in effect persisted in RCN's internal organisation, so little was achieved (except perhaps some administrative savings – unclear). In response to our 2001 evaluation, RCN reorganised into a science division (run like a research council), an innovation division (run much like TEKES or VINNOVA using stakeholder programme committees) and a 'large programmes' division. This was intended to be an 'arena' which could implement large time-limited programmes – horizontal or vertical, as needed to conform with policy. In the late noughties, this became so large that it was split into two thematic divisions to make the division boards more relevant and focused. Many of these programme respond directly to priorities in the four-yearly research Bills and will now also respond to the priorities of the new Long-Term Plan for research and innovation. Note that these Bills and the Plan result from cross-ministry consultation and coordination (with significant input not least from RCN): the education ministry (which drafts them) does not have the power to over-rule the other ministries' priorities.

Sweden – Swedish Research Council

- VR comprises three thematic research councils funding PI-initiated research, all but two of whose members are elected by the academic community. There are X committees. In addition there is a council for research infrastructure and five committees funding bottom-up research in socially relevant areas such as education and clinical medicine. These have a lower proportion (but still generally a majority) of academics, who are appointed by the Board rather than being elected. The Board comprises a Chair, one academic member and a DG are appointed by the education ministry and 6 other academics who are elected.
- The administration supports the councils and committees. It has a group that manages the SUNET academic computer network and a research policy group that organises analysis, evaluation and advice to government, essentially providing services to the organisation rather than taking any strategic initiative. VR was originally conceived as a change agent for improving Swedish research but – as the 2008 evaluation showed – completely failed in this task. The research policy group was quickly downsized and VR remains highly conservative, because of its academic governance. It was a late and rather reluctant adopter of centres of excellence funding.
- To the limited extent that VR has strategies, these are developed by the councils, primarily focusing on platitudes such as 'excellent research'. There appears to be little or no cross-talk between the councils and no real central strategy.

Switzerland – SNF

- The SNF is divided into 3 thematic 'divisions' (Arts, Hums and Social sciences / Engineering and physical sciences, bio and med science), plus division 4 for 'programmes'.
- All statutes and policies cover the whole organisation: there are no strategies as such for the individual divisions. There are specialised committees for interdisciplinary research, careers and international cooperation, which work across all divisions, as do two further commissions, one for gender equality, one for research integrity.
- The bedrock of the organisation is the 'research council', and research councillors are divided into the 3 main divisions
- There is some freedom for individual divisions in terms of process, e.g. division 3 (bio and med science) make greater use of metrics in their funding decisions.

- The non-disciplinary aspects (e.g. in the programmes division) draws on research councillors from other divisions. In other words, individual subject divisions have minimal scope to develop their own strategies a, policies or programmes, but are drawn together from the relevant commissions of the programme division to assist in cross-cutting activity.

Table 5: Expert panel overview data - Programming

Programming
<p>Austria – FWF</p> <ul style="list-style-type: none"> • Most FWF funding goes in programmes where funding is accepted on a rolling basis. Only on an exceptional basis (ERANet, PEEK, specific high level award programmes with a specific selection panel) calls are published. • Primarily, FWF is funding projects on a bottom-up basis, new funding programs are rarely designed. • The document “General principles of the FWF decision-making procedure” provides a brief overview of the application process, from the submission of proposals to the peer review process and the final funding decision. The process described in the document forms the basis for all FWF programmes. In certain programmes, exceptions to the general decision-making principles are possible; these exceptions are described in separate documents.
<p>Belgium/FL – FWO</p> <ul style="list-style-type: none"> • The FWO implements only few thematic programmes, which represent a small share of their budget. The thematic programmes are mainly research grants based on donations or project funding in support of specific thematic campaigns³⁴. Most of the programme design is done at the policy level (the ministries) resulting all main programmes to be based on Government Decrees. This means that the programme design process is political and while it is supported by the FWO, it has limited impact on the programme design. • As the programmes are either non-thematic or the thematic priorities are pre-defined, FWO has little influence on the design of individual calls. FWO can decide on the timing of the calls and how they are managed (e.g. which Expert Panels are consulted), and suggest the available budget, which is decided at the ministry level.
<p>EU – ERC</p> <ul style="list-style-type: none"> • The European Research Council consists of a Scientific Council (ScC) and an ERC Executive agency (ERCEA). The ScC is the decision making body of the council and sets the scientific and funding strategy while the ERCRA implements the strategy and oversees the day-to-day administration of the grants. The ERC Board ensures the effective link between these two constituents of the ERC. An ERCEA Steering Committee supervises the ERCEA operations, while a Secretary general ensures coordination with the European Commission. • Although there are no quotas for different scientific fields in ERC grants, the planning and operation of the evaluation of ERC grant proposals is done by different specialized panels according to the scientific field of the project. There are 25 panels that cover all fields of science, engineering and scholarship assigned to three research domains: Social Sciences and Humanities (6 Panels), Physical Sciences and Engineering (10 Panels) and Life Sciences (9 Panels). That allows a classification of the projects that into areas and sub-areas. The panel names are accompanied by a list of panel descriptors (i.e. ERC keywords), these should be read in the overall context of the panel's titles and sub-titles and but indicating the fields of research covered by the respective ERC panels. • As with the other areas of the framework programme. ERC work programmes are published in advanced describing future calls and their features.
<p>Finland – AcaFi</p> <ul style="list-style-type: none"> • The design of new programmes is a relatively open and transparent process at the Academy of Finland. It relies on ideas collected from open consultations with researchers and ideas from other sources. These ideas are discussed at a joint workshop for the Academy’s main 4 Research Councils, and at the Academy’s units supporting the work the of these Councils. Based on these discussions, a proposal is taken to the Academy Board for decision. This proposal is an analysis of all discussed ideas, of which the most promising ones are suggested to be developed further into new programmes. A preparatory group is appointed for each potential new programme idea. The group finalises the design of the new programme. The final decision to allocated funds to the programme and launch it is made by the Academy Board. Programmes are operational typically for 3-6 years. The new programme design process is run annually.³⁵ • The design of calls and programmes for the Strategic Research Council is based on themes selected by the Government. Potential themes are collected using open consultations, foresight activities, workshops and hearings. The Strategic

³⁴ see <http://www.fwo.be/en/fellowships-funding/research-grants/> and <http://www.fwo.be/en/fellowships-funding/research-projects/>

³⁵ see http://www.aka.fi/globalassets/32akatemiaohjelmat/yleiset-asiat/academy-programmes_eng_08-05-2017.pdf

Research Council then analyses these and makes a proposal for the Government, which makes the final decision. Based on this annual decision, new programmes and calls are designed and managed by the Council.³⁶

- The contents of each individual call within an operational programme is decided by the programme Steering Committee (or the respective programme subcommittee). The Committee is appointed by the Academy Board to oversee the implementation and monitoring of the programme. Steering Committees (or subcommittees) are composed of members from the appropriate Research Councils, other funding organisations, and external experts.
- The contents of each individual non-programme related call are decided by the respective Research Council (or a non-programme subcommittee).

France – ANR

- ANR has a single system for calls which is the annual work programme. It is ‘*produced in cooperation with the research ecosystem (the five Alliances³⁷, the CNRS and the Ministry responsible for Research and Innovation, etc.), to coordinate interministerial action between the ministries concerned respecting the line set down by the National Research Strategy (SNR).*’ The calls are increasingly articulated to the National research strategy which is itself increasingly articulated with the EU strategy in H2020.
- ANR has a Scientific Advisory Board³⁸ that reflects and debates on the preparation and implementation of its annual WP.
- Since 2017, the ANR organises in September the ‘ANR tour’ in France. The ANR tour consists in setting up meetings with researchers in different cities (up to 20 meetings a year) to present its WP and to answer question directly.
- ANR faced (and may still face) a big challenge with regards designing calls and schemes: ‘*increase transparency, impartiality and shared understanding of the selection process*’ is the number 1 objective out of the 5 objectives included in the 2016-2109 contract signed with the French State³⁹. Indeed, ANR average success rate fall to 11.5% since 2012 which created negative reactions and exhaustion among the French research community that questioned the selection process.

Germany – DFG

- DFG funding is provided on a competitive basis in individual grant programmes (Research Grant, Scientific Networks, Research Fellowships, Emmy Noether Programme, Heisenberg Programme, Reinhard Koselleck Projects, Clinical Trials), and increasingly via coordinated programmes, promote cooperation and structural innovation by encouraging national and international collaboration in areas of current relevance and by concentrating scientific potential at a university (Priority Programmes, Research Training Groups, Collaborative Research Centres, DFG Research Centres, Research Units, Clinical Research Units, Centres for Advanced Studies in HSS.)
- The 48 DFG review boards (“Fachkollegien”) evaluate proposals to fund research projects. They also monitor the review process to ensure that uniform standards are being observed. A group of subject areas that are scientifically linked form one review board. As a consequence, projects are evaluated within thematic groups and not – like for instance in the Austrian FWF – by a multidisciplinary panel. Final funding decision is taken by the Joint Committee (Hauptausschuss).
- The Joint Committee decides on the implementation of new funding programmes and on modifications to existing funding instruments. Review boards advise on issues concerning the further development and organisation of the DFG funding programmes.

Luxembourg – FNR

- The FNR has a broad set of programmes addressing thematic fields on the one hand and thematically open strategic programmes.
- The Luxembourg context is particular in the sense that during the last two decades, there was a continuous increase in public investment in research, the creation of four research centres, and more recently a University. The FNR is the main competitive funding source in Luxembourg and has replaced project based funding directly managed by the Ministry in charge.
- It has regularly adapted its portfolio to the moving context, phased by the 4-years funding contract with the Ministry.
- Programmes and calls are prepared by the FNR, supervised by two boards: administrative and scientific.
- Within the framework of the contract negotiations with the Ministry, FNR has a high degree of flexibility to design programs and procedures.
- Given the small size of the country, transparency does not seem to be a problem, FNR is engaged in regularly informing research stakeholders about new open calls.

³⁶ see <http://www.aka.fi/en/strategic-research-funding/themes/theme-process/>

³⁷ 5 alliances: Life science and health; Energy; Humanities and social sciences; Environment; ICT.

³⁸ Scientific Advisory Board is composed of the ANR head of scientific departments, a maximum of 7 persons coming from outside of ANR whose competences fall into the agency’s activities and 3 persons from socio-economic/ business sphere.

³⁹ <http://www.agence-nationale-recherche.fr/fileadmin/documents/2017/ANR-COP-page-a-page.pdf>

- It is interesting, because FNR has a portfolio of very different programmes, going from funding of high level research groups to very applied technical research and knowledge transfer. However, given both the financial situation of the country and the small size, experience is not easy to transfer to other environments.

Netherlands – NWO

- The three domains of NWO have relative freedom in adapting their working methods to the specific needs in their scientific fields. They benefit from central coordination of calls and schemes, with clustered legal and financial expertise which, in practice means a toolbox set of instruments to choose from.
- Currently, however, the procedures and calls of NWO do vary substantially between the different domains and are often adapted for individual calls, based on the conditions of different funders or the specific needs of the calls. A large variety of instruments is used.
- The integration of areas as a result of the reorganisation should enable an improvement in effectiveness and efficiency and in coherence of calls and schemes. This will take some time to develop, as the reorganisation focused at first on improving the structure of NWO. In the future, NWO aims to make its working procedures more uniform and transparent and intends to improve coherence in programmes aimed at researching societal challenges. This includes the plan to use similar instruments in the entire organisation.

Norway – RCN

- RCN defines processes at the centre, so the divisions work with various sub-sets of the overall common processes. This also means they can run a common IT system from application to post-project monitoring. (This has taken a very long time to achieve.)
- It is hard to get an overview of all RCN's programmes – though it is probably only international policy analysts who want this overview. However, Calls are proactively communicated to relevant parts of the research and industrial communities as well as being advertised. Part of RCN's mandate is to act as a 'meeting place' so there is a continuous programme of meetings and conferences involving stakeholders in discussions about research results, needs and policy that creates dialogue within the relevant communities as well as with RCN. These do not negotiate with RCN about how it programmes, but provide large amounts of information that RCN uses in planning and in negotiating with the ministries about programmes and budget. This complements the 'top-down' input on programming from the government and ministries with 'bottom-up' input from the stakeholders. The processes run by the RCN itself is complemented by so-called national processes for R&D-strategies in specific topic areas such as Renewable Energy, Maritime, Environment, Health. These processes are initiated by a Ministry with the work done by a broad committee of stakeholders and with the RCN-staff as secretariat.
- RCN has a standard set of 17 funding instrument or 'project types', which all divisions are free to use. There are 'researcher projects' aimed at academics, 'innovation projects' aimed at industry-academic partnerships and a wide range of intermediate instruments including centres of academic excellence and centres of innovation excellence. This means that – especially in the two thematic divisions – it is possible to combine everything from basic research to SME innovation in a single programme and thus address both societal challenges and develop strategies that deal with both the long term and how to get there. This will shortly be changed to seven somewhat broader categories, partly due to over-use of the 'other' category featuring among the 17.
- Bottom-up (PI-initiated) funding is routinely available from the science and innovation divisions. RCN can move projects into or out of programmes, but does not do so to a great extent.

Sweden – Swedish Research Council

- The web site is well laid out and informative. VR operates a common applications system – PRISMA –with the two other research councils Forte and FORMAS so that researchers have a single account across all three. It is not clear how this relates to the back-office funding and monitoring systems.
- PRISMA is probably the only interesting feature for the present study.

Switzerland - SNF

- The design of individual calls and programmes is somewhat opaque at SNF. National research programmes are something of a flagship, and one or two a year are launched. The process of understanding how the programmes are designed is notoriously complicated and has been subject to many modifications over the years. Input from multiple organisations (including various ministries) leads to frequent modification of programme aims and objectives. The process is also quite long, up to 3-4 years from first deliberations to start of the research
- Sinergia is a further funding tool, seeking to fund interdisciplinary, breakthrough, collaborative research. The evolution of this programme and its calls is comparably opaque
- There is no system as such that determines the content and exact details of each call or programme.
- Ultimately, the selection of tools, calls and programmes at SNF is diverse and innovative (including 'use-inspired basic research, Sinergia, NRPs on many different topics, etc. so the results reflect creativity, the processes are opaque.

Table 6: Expert panel overview data – IT systems

IT systems
<p>Austria – FWF</p> <ul style="list-style-type: none"> • The FWF has a department for Policy, Evaluation and Analysis, more precisely in charge of Strategy Development, Research Statistics and Documentation, Scholarly Communication, Research Integrity, Programme Evaluation. • The FWF applies the standards of the Austrian Platform for the Evaluation of Research and Technology, which stipulate that funding programmes that dispose of more than 1 million € per year should be evaluated every five years. All of the FWF's most important funding programmes have been evaluated by international, independent and expert institutions (or companies), the results are published on FWFs homepage. • The FWF has a good monitoring system and cooperates with academic partners to analyse funding data, i.e. in order to identify any possible impact of the selection process on the gender balance of PIs in funded projects. • The FWF website provides funding statistics and comprehensive data on open access publications linked to the grants it funds and associated publication costs. A recent exercise provides altmetrics of these resulting publications, but it is not clear if all this information is kept in a central repository. There was an early unsuccessful attempt at a national research information system for Austria to capture national projects (prior to 2006, named <i>AURIS Austrian Research Information System and FODOK</i>). <i>Not much information remains online about that experience.</i> • There is more information on University of Vienna's own institutional repositories (u:cris). The University Act 2002 and Regulation for the Intellectual Capital Report at Austrian Universities serves as a primary guideline on the kind of data that have to be collected by institutional systems in Austria, but it is not clear if this is also collected at funder level. A presentation from the University of Vienna stresses the fact that due to the requirements of the Intellectual Capital Report these systems were deployed at institutional level with <i>mostly in-house development and implemented in a rush.</i>
<p>Belgium/FL – FWO</p> <ul style="list-style-type: none"> • The FWO has a web-based IT system E-Loket, which offers on-line services to both applicants and reviewers.⁴⁰ The same interface also allows access to the FWO extranet. The system covers applications and scientific reporting. The system itself is simple and user friendly. • The system is internal to FWO. VLAIO⁴¹ doesn't use the same system, nor do any of the other funding organisations. • In terms of a national research information system, the FRIS (Flanders Research Information Space) provides open information on researchers, projects, publications and institutions. This information is harvested from participating institutional systems and is aggregated in a way similar to the UK Gateway to Research. FRIS is funded by the Department of Economy, Science & Innovation (EWI).⁴²
<p>EU – ERC</p> <ul style="list-style-type: none"> • Responsible research data management has been a major concern for the ERC since the very beginning. The executive agency responsible for the ERC manages a CRIS developed specifically for the Council. After a public tender process, a custom implementation of the CONVERIS platform from AVEDAS was selected as the data warehouse where all the information is stored after a cleaning and validation process.⁴³ The ERC, like most other agencies in Europe, has a need to account for the added-value of its funding activities and the ScC wanted to have a system that allowed for the monitoring and evaluation of the ERC activities. As a result, the rationale for setting up the system revolves around the concept of accountability. The long-term goal for the ERC information system is to be able to systematically collect and link all the relevant data that would be needed in order to analyse the impact of the Council in multiple facets. However, this is done in incremental steps. The current functionalities of the system are: <ul style="list-style-type: none"> – Helping the ERC reporting to public authorities and to the general public and automating the download of data on publications, citations and journals. An early press release from Elsevier mentions this preferred partnership with the ERC in order to supply them with data on publications to be considered in the review process of grants⁴⁴ – Reducing the administrative burden on researchers that have ERC grants • Currently, the system focuses in the coverage of ERC funded activities. Further into the future the ERC would like to collect any data that might be needed for benchmarking purposes. Periodically, the ERC launches a limited number of M&E studies that build on the data provided by their internal systems and that also aim to explore how to make the information more comprehensive.⁴⁵

⁴⁰ see <http://www.fwo-eloket.be/FWO.ELoket.WebUI/Login.aspx>

⁴¹ VLAIO (AGENTSCHAP INNOVEREN & ONDERNEMEN) is an innovation funding agency for the Flanders region. They also have a web-based IT system for similar purposes, but it is not the same as the one used by FWO.

⁴² See <https://researchportal.be>

⁴³ See https://erc.europa.eu/sites/default/files/content/events/P7_ERC_Research_Information_System_ERIS.pdf

⁴⁴ See <https://www.elsevier.com/about/press-releases/science-and-technology/european-research-council-selects-elseviers-sciverse-scopus-database>

⁴⁵ See <https://pdfs.semanticscholar.org/ebce/8edb7277c57bc86510c7e532e2fe3a42aa33.pdf>

<ul style="list-style-type: none"> Especially in the area of Open Access to research results, the ERC has been a frontrunner. In its very first Statement on Open Access from 2006 the ERC Scientific Council announced that "it is the firm intention of the ERC Scientific Council to issue specific guidelines for the mandatory deposit in open access repositories of research results – that is, publications, data and primary materials – obtained thanks to ERC grants, as soon as pertinent repositories become operational."
<p>Finland – AcaFi</p> <ul style="list-style-type: none"> The Academy of Finland has a centralised IT system, which offers on-line services to both applicants and reviewers.⁴⁶ The system is internal to Academy of Finland. The system covers applications, monitoring (financial and scientific reports), payments as well as some information of results and further impacts. Business Finland⁴⁷ doesn't use the same system, nor do any of the other funding organisations. The system itself is very user friendly and covers a lot of ground. The system is partly integrated into other research information systems, allowing analyses covering Academy of Finland and other data, e.g. from Universities.
<p>France – ANR</p> <ul style="list-style-type: none"> Impact analysis and open data are the third big objective in the ANR contract 2016-2019. The Scientific Operations Division of ANR has two units dedicated to data and impact studies (i) Data and impact analysis unit and ii) Competitiveness and Economic impact of research unit). However, according to the <i>Survey on Impact study: reflections, practices and requirements</i>⁴⁸ France, and ANR does not yet fully reflect and implement impact studies. The topic is therefore discussed and worked on but the results and processes are not yet visible to the general public. At the national level Amue (Agence de mutualisation des universités et établissements,) together with CNRS, are behind the development and maintenance of institutional systems and solutions to aggregate information on budgets, financial information, projects and people.⁴⁹
<p>Germany – DFG</p> <ul style="list-style-type: none"> A wide range of information about current and completed DFG-funded research projects is available in the online database GEPRIIS. The DFG uses evaluations to assess its funding programmes and policies and to identify dynamics in the research landscape. It can then improve its processes and programmes and align them with these dynamics. Infobriefs and quantitative and evaluative studies ensure the transparency of funding activities. Evaluation standards are used to formulate the quality requirements for evaluative studies and the evaluation process. DFG publishes a "funding atlas" (latest edition: 2015), a report on key figures relating to publicly funded research in Germany This edition is the seventh in the series, which began in 1996. While the first edition concentrated solely on indicators of the participation of higher education institutions (HEIs) in DFG funding programmes, since then the spectrum of indicators has been considerably enlarged and further developed in its focus.
<p>Luxembourg – FNR</p> <ul style="list-style-type: none"> As in many funding agencies, FNR has an information system tailored to its services, and not primarily to overall monitoring and evaluation. The system has improved in recent years, so that it is possible to get time series for about 5 years, per thematic area. However, the system is not yet integrated. Moreover, regular reforms of programmes lead to gaps in data. Impact data are not collected systematically, but evaluations of impact are commissioned.
<p>Netherlands – NWO</p> <ul style="list-style-type: none"> Every applicant is obliged to report their outputs in one electronic system (which is also used for submitting proposals). Outputs include PhD theses, scientific publications, popular articles, books, conference papers and patents. But it might also include broader outputs such as abstracts, editing work, inaugural speeches, prototypes and appearances in the media. These outputs form the basis of monitoring focused on the attribution of NWO to its aims. The key details of projects are published online. The domain Applied and Engineering Sciences publishes a yearly report on utilisation of the funded projects that started five or ten years previously. In this report, they assess user involvement, products and resulting revenue of projects.

⁴⁶ see <http://www.aka.fi/en/funding/how-to-apply/online-services/>

⁴⁷ The relevant organisation is Tekes, which is currently part of Business Finland.

⁴⁸ H2020 Tools and Actions for Impact Assessment and Policy makers Information project, <https://taipi.eu/>

⁴⁹ See https://dspacecris.eurocris.org/bitstream/11366/386/1/N4_Pr%c3%a9sentation_Amue_2015_ENG_v1.1.pptx

<ul style="list-style-type: none"> At the moment, NWO is working on a new planning, monitoring and evaluation (PME) strategy, which aims to be consistent for all domains with room for specific adaptations to each field of science. NWO plans to involve societal stakeholders for the assessment of the societal impact.
<p>Norway – RCN</p>
<ul style="list-style-type: none"> RCN has a single IT system from proposal to post-project monitoring. Only research outputs are monitored post-project – and then only for a couple of years. Non-scholarly impacts are not monitored. SME innovation project beneficiaries have been surveyed annually for a couple of decades. RCN evaluations are often panel-driven and therefore weak on assessing outcomes and impact. An education ministry agency runs the national RIS CRISTin (http://www.cristin.no/om-cristin/). All universities and research institutes are required to provide publications information annually. The agency quality-assures the data and classifies the data and allocates it to two quality categories, based partly on data from the commercial bibliographic databases and partly on a classified list of non-indexed journals (especially in Norwegian) agreed by a committee of the universities' association. In principle, outputs are classified as belonging to the top 10% of output or to the bottom 90%. This information is used in the national performance-based research funding system that affects institutional funding. RCN has a large database describing current and past projects. This is publicly available on its web site. It forms one element of what RCN calls the 'knowledge base' (Kunnskapsgrunnlaget), which is essentially the qualitative and quantitative evidence base it uses to support its activities, including programme design, and in providing advice to government.
<p>Sweden – Swedish Research Council</p>
<ul style="list-style-type: none"> There is no description on the internal IT systems used but data on projects from the Swedish Research Council, along with 11 other funders in the country, are openly available through the Swedish national CRIS SweCris. SweCris was commissioned by the Swedish Research Council in 2012 and replaces the previous Sweden ScienceNet (SSN) run by Uppsala University. The new system allows the users to generate reports and simple analytics online and encourages institutions to make use of open unique identifiers such as ORCID and standard classifications to improve data quality.⁵⁰
<p>Switzerland - SNF</p>
<ul style="list-style-type: none"> In 2011, the SNF introduced its new research information system, 'P3'. This is internal to the SNF and fully integrates everything from application to reporting of publications (full references to all outputs), and some information on further impacts (though mostly awards and honours rather than more detailed impact stories). This allows tracking of successful vs unsuccessful application, as well as appraisal of which projects lead to which outputs. As we found out working for snf, this also makes things like bibliometric analysis quite easy, as the publications data is suitably detailed. Individual researchers can also be tracked in terms of which grants they are associated with, though there is no direct link between individual researchers and publications – individual grants are the main 'unit of analysis'. Some aspects of P3 data can also be accessed externally with no sign-up or other checks, though this is limited to what people and projects are funded, and the publication lists (application data is confidential). InnoSuisse does not use the same system. The system itself is very user friendly and covers a lot of ground. As it is relatively new, it presents very good practice at a basic level. However, there is no known integration with any other systems as such.

Table 7: Expert panel overview data – Peer review

<p>Peer review</p>
<p>Austria – FWF</p>
<ul style="list-style-type: none"> At least 2 reviews per project are received from peers working abroad, they don't meet physically After all reviews have reached the FWF, the following Board meeting decides on funding. The review process takes several months. Very classical: 2-3 peers per submission, allowance for vetoing specific peers.
<p>Belgium/FL – FWO</p>

⁵⁰ See https://www.swecris.se/sv_se/om-swecris/

- The FWO has a basic uniform process for its research project and research grant funding: application is submitted on-line; the FWO internal experts check for eligibility; eligible applications are sent to selected External Expert Panel members for review; selected External Experts Panel members review the application in full and submit their written review; the FWO internal experts collate the reviews and prepares an outline of the proposal ratings and overview of the call to the Panel; the whole Panel decides on ranking and proposes projects for funding; Board of Trustees makes the final decision. This happens in multi-annual rounds depending on the timing of the individual programmes and calls. The FWO selects the appropriate Expert Panels depending on the thematic contents of the applications and/or the orientation of the call (project call, grant call, programme call, etc.).
- Applications are graded from D (unacceptable) to A+ (top, should be funded)⁵¹. The individual grading is used as a supporting tool for the actual ranking of proposals. The Panel ranks the proposals in three groups: 1st order projects (outstanding proposals), 2nd order projects (very good applications), and non-ranked proposals. The cut-off point is eventually decided based on funding availability, and typically allows all 1st order and some 2nd order projects to be selected for funding.
- The peer review process in specific programmes such as the SBO makes use of the thematic Expert Panels for the individual assessment. The ranking and funding proposal, however, is made by the two SBO programme Panels.
- FWO has detailed regulations and guidelines for both internal and external peer reviews.⁵²

EU – ERC

- Peer review guidelines are published for each of the main types of ERC grants, which describe the process of peer review.
- For Starting, Consolidator and Advanced Grants a single submission of the full proposal will be followed by a two-step evaluation. The evaluation is conducted by means of a structure of high level peer review panels which may be assisted by independent experts working remotely. Individual reviews are carried out prior to panel meetings. Panel Members and Remote Referees participate in the individual review stage and there is clear guidance for how to deal with interdisciplinary proposals.
- To the ERC, qualitative peer review analysis remains the gold standard for in-depth assessment of research outcomes. This is why the ERC Scientific Council requested, as part of the 2015 Work Programme, an analysis of the results and outcomes of ERC research funding evaluation, following this approach. In this evaluation, which serves as a pilot exercise for the future evaluation of completed ERC-funded projects, the qualitative evaluation of 199 completed ERC-funded projects was undertaken by independent high-level scientists who were selected by the ERC Scientific Council.

Finland – AcaFi

- The Academy of Finland has a basic uniform process for its mainstream grant funding: application is submitted on-line; the Research Council Support Unit experts check for eligibility and select at least two external expert referees (or in some cases a panel is used); external experts (or the panel) review the application in full and submit their written review; the Research Council Support Unit experts collate the reviews, add comments and make a recommendation at the Research Council (one of the main 4, or Strategic Research Council, or the Finnish Infrastructure Committee, or one of the subcommittee) meeting. This happens in multi-annual rounds depending on the timing of the individual programmes and calls.
- Applications are graded from 1 (poor) to 6 (outstanding) and a cut-off point is decided based on funding availability.⁵³
- For most Academy projects the application process is one stage. Most programme calls use a two-stage approach, where the first one is leaner and less bureaucratic. This helps reduce the reviewing burden, but remote reviews and panel decision is still the mode of operation.
- Academy of Finland makes much use of international reviewers; over 95% of all external expert reviewers are non-Finnish. The small size of the country makes this imperative to guarantee somewhat independent reviewing.
- The same peer review process is used by the main 4 Research Councils, the Strategic Research Council, and the subcommittees. The review process used by the Finnish Research Infrastructure Committee differs from the main process due to its specific nature.

France – ANR

⁵¹ http://www.fwo.be/media/793255/guidelines_panel-members_20180316_ob.pdf

⁵² <http://www.fwo.be/en/the-fwo/organisation/fwo-expertpanels/regulations-fwo-internal-and-external-peer-review/>

⁵³ see e.g. http://www.aka.fi/globalassets/20arviointi-ja-paatokset/liitteet/instructions_for_reviewing_research_applications_individual_reviewers_2017.pdf

<ul style="list-style-type: none"> • ANR simplified its selection process (in line with a poor overall success rate) which is now a two stages process with: stage 1 consisting in a 4 pages description of the proposal and stage 2 (if short-listed) a max 20 pages description of the project. It is planned that 2500 to 3000 applicants will be short-listed for stage 2 (2018 applicant guidelines). • There are about 50 Scientific Evaluation Committees (SEC) (50 different scientific topics) involved in the peer review process. SEC are used for stages 1 and 2 of the process. The Project coordinator that apply for a grant chose its SEC in stage 1 and cannot change it afterward. Detailed applications are reviewed by a minimum of 2 peers. The applicant can identify in stage 1 the name of peers that should not be involved in the project evaluation. • For the 2018 generic call, an annual planning was set with stage 1 spanning from September 2017 to February 2018 and stage 2 from February 2018 to July 2018.
<p>Germany – DFG</p> <ul style="list-style-type: none"> • For each incoming application for funding, the DFG office will ask technically competent scientists to prepare formal written reports. The reports contain a vote on the funding decision. The vote may also amount to partial funding of an application. The reports are discussed several times a year in the meetings of the review boards and the votes either confirmed, modified or rejected. As a result of a meeting of a review board, a funding proposal will be forwarded to the main committee through a larger number of applications. • Expert database is managed in the scientific departments of DFG • Peer review is provided on a voluntary basis. • To avoid conflicts of interests, peers are asked to inform DFG before submitting their review, so that other experts can be contacted.
<p>Luxembourg – FNR</p> <ul style="list-style-type: none"> • Peer review is important, due to the small size of the country, peers are obligatory coming from abroad. • Review processes are tailored for each programme, and described in various guidelines available online • This process is important and shall ensure the scientific quality. At the same time, FNR defends a “research for impact” paradigm, which might counteract these efforts. • The fact that Luxembourg is not yet established as a most visible research country leads to high investment in peer-review processes, perhaps less efficient compared to well established organisations like Alexander von Humboldt-Stiftung, who can count on its long term reputation. This holds for instance for the selection of Pearls (Attracting established leading researchers in strategically relevant areas for Luxembourg), with far higher efforts compared to the Humboldt-Professor, who receives comparable funding in Germany.
<p>Netherlands – NWO</p> <ul style="list-style-type: none"> • Peer review at NWO is organised in an efficient and effective way. Proposals that comply with the admission criteria are sent for peer review by independent referees. After the opportunity for applicants to react, a committee or jury assesses the referee's report and applicant's rebuttal. Sometimes an interview or site visit is included in the assessment procedure. • A pre-proposal may be part of the procedure, to prevent too many applicants wasting time on proposal writing when NWO expects the number of proposals to greatly exceed the available budget. • A jury of generalist experts or lays might be used to review proposals judging from a broader perspective, which occurs mainly in the Applied and Engineering Science domain. • NWO mainly uses referees from outside the Netherlands to prevent bias or conflicts of interest. All referees, committee members and NWO staff sign NWO's Code of Conduct on the Conflict of Interests. • In June 2017, NWO explored alternatives organising an international peer review conference. As a result, NWO implemented several measures to reduce application pressure. Other promising measures require more research, such as the limitation for one researcher to hold one grant at a time, to prevent the occurring of the ‘Matthew effect’⁵⁴
<p>Norway – RCN</p> <ul style="list-style-type: none"> • Peer and expert review is used in proposal assessment across almost the whole of RCN. In the large programme of responsive mode funding (Fri prosjektstøtte) the remote peer review is replaced by a large number of panels, where each panel member accepts to review between 10-25 applications and meet in Oslo with the rest of the panel to review and rank the applications. Accordingly, the main instrument for innovation projects is evaluated by panels, in some instances the members get the applications at the panel meetings. The exception is in the innovation division's capacity-building projects for SMEs. These are awarded by the administration (which has the right to invite expert comment if it desires). • Each of the funding instruments has a specific assessment process. Those orientated to basic or PI-initiated research use traditional panel review, only considering scientific quality. Thematic programmes use panels comprising both academics

⁵⁴ The effect of an undesirable accumulation of grants by the same person, as a result of procedures in which excellent researchers are more likely to obtain funding for large research proposals than talented young researchers at the start of their careers.

and suitably qualified non-academics. Scientific quality is always an assessment criterion, but there are varying numbers of relevance criteria in addition. This has meant that scientific quality scores of funded projects have tended to be lower in the bottom-up than the thematic programmes for three reasons: each thematic programme inevitably addresses a smaller set of potential applicants than the non-thematic ones; panels to some degree trade quality and relevance off against each other; and thematic programmes are sometimes about building capacity (including in areas of basic research).

- A recent spending review of RCN – inspired by complaints from the basic research community – was required to propose how to reallocate over 10% of the budget towards ‘excellent’ research. This would have involved reallocating ‘mission’ funding from other ministries to the bottom-up territory of the education ministry, so it was politically infeasible under any circumstances. I understand RCN is considering one proposal from the review, which was to set a minimum quality score for any application to be granted.

Sweden – Swedish Research Council

- VR uses panel review in the councils, each of which has a large number of ‘preparation groups’ that organise peer review (by electronic means). We would need to ask them in order to understand how they manage the acquisition and use of peer reviewers, which requires considerable organisation and scientific understanding. (The Austrian research council FWF claims to be among the best at this – but I have not been able to check that claim.)

Switzerland - SNF

- The SNF has basic uniform process for its mainstream grant funding: application is submitted, office checks for order and eligibility and selects a referee from the research council. The referee then selects remote expert reviewers. They review the application in full; the referee then collates reviews, adds comments and makes a recommendation at the research council meeting. This happens in multi-annual rounds. Applications are graded from A-D and a cut-off point is decided based on funding availability.
- A small modification to this process happens for ‘use-inspired’ applications, where an additional statement is added to the application, but aside from this the system stays quite rigidly the same.
- For programmes (NRPs) it is different. There are two stages for applications, an outline stage and a main stage. This helps reduce the reviewing burden, but remote reviews and panel decision is still the mode of operation.
- Division 3 makes some use of metrics, the others don’t. for programmes, fit with programme remit is added as criteria, but other than that criteria are fairly generic.
- Switzerland makes much use of international reviewers, both for the remote part, and to an extent in the research councils. The small size of the country makes this imperative to guarantee somewhat independent reviewing.

B.2 'Deep-dive' evidence call

For our second evidence call, we asked our panellists to provide more detailed information on a range of questions on each of the funders covered:

Policy structures: centre and periphery

Rules and standards: where does the central organisation of UKRI end and the individual councils' own 'identity' begin?

- How is multi/inter-disciplinarity facilitated? Are there ring-fenced schemes? Is it mandated for all programmes? Does mainstream grant funding have some form of interdisciplinary 'option'? More broadly, does the organisation try to facilitate an inter-disciplinary 'ethos' and operation, if so, how?
- How are strategic priorities like 'scientific excellence' 'translation and impact', 'mobility' or 'diversity' executed and weighed up against each other? Who decides whether one is more important than the other?

Designing calls and schemes

Designing calls and schemes: how to have a user-friendly, standardised system, which enables creativity and flexibility, but also ensures the portfolio of schemes and calls is fully transparent?

- Is there a single 'default' procedure used for designing new schemes and issuing new calls for proposals that is used across the organisation (i.e. it would be followed for a response mode grant, or a fellowship or a centre of excellence)?
- Is there a 'suite' of standard options that can be added or taken out of particular calls as necessary (e.g. remote review, include/exclude wider impact statement, payment type, restricted vs open application eligibility, etc.)?
- Is there a standard process for finding agreement on the design of schemes or calls? How are conflicts of opinion and the need for multiple inputs from different parts of the organisation managed?
- Is there a sense that the design of schemes and calls is well done and transparent?
- Are there any tools or techniques that are used to shorten the time from scheme inception (idea) to the announcement of the call (launch)?

IT systems

IT systems: Monitoring of data from inputs to impacts, integration with other (external) data sources

- What kind of IT system(s) does the funder use? Is it all one system from application to peer-review, admin, monitoring and evaluation? Is the system generally accepted to be user-friendly, modern and fit for purpose?
- What information does the system / do the systems capture?
- Does the system only track individual grants/awards, or also specific people or research groups, or longer-term projects consisting of multiple awards?
- Is there any integration or common use of IT systems between research and innovation funders (or research and innovation departments within the same funder)?
- Are internal grants data (applications, failures, successes) and outputs & impacts data captured by the same system?
- Is the research grants IT system integrated or connected to other (external) monitoring systems (e.g. on PhD studentships, PatStat, other funders' grants data, etc)?

- Are grant holders expected to continue to provide regular updates on outcomes and impacts beyond the life of a specific research grant, and if so how is that operationalised?

Peer review

Peer review: How to operationalise this cornerstone of science funding in the most efficient and effective way

- When does the funder use remote reviewers and when does it use review panels? (if there is a web-link to a page outlining/visualising the funder's approach, feel free to insert)
- Do panels always meet physically? If applicable, please elaborate on any experiments with virtual panels.
- Are there any cases where aspects of peer review are by-passed? (e.g. for small mobility grants or innovation vouchers where eligibility is checked by the administration and awards are then allocated on a first-come first-served basis)
- What is the division of labour between those aspects of a grant application that must be subject to peer review and any other components that may be tackled by the funder's internal research managers (e.g. eligibility statements, project management, financial statements, etc.)
- Are there techniques to limit the peer review burden? Are there any known pros and cons associated with these techniques?
- Is everything conducted in periodical funding 'rounds' or are there cases of continuously open calls, with standing review committees and continuous funding decisions?
- What are reviewer response rates like? (i.e. share of people invited to carry out a review that agree to help and then go on to provide a review)? Has anything been done to boost response rates?
- Are there any clever or interesting processes/tools to control the trade-off between budgets and success rates (demand management)?
- Are there any techniques or tools to shorten turnaround-time from application to grant start?

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