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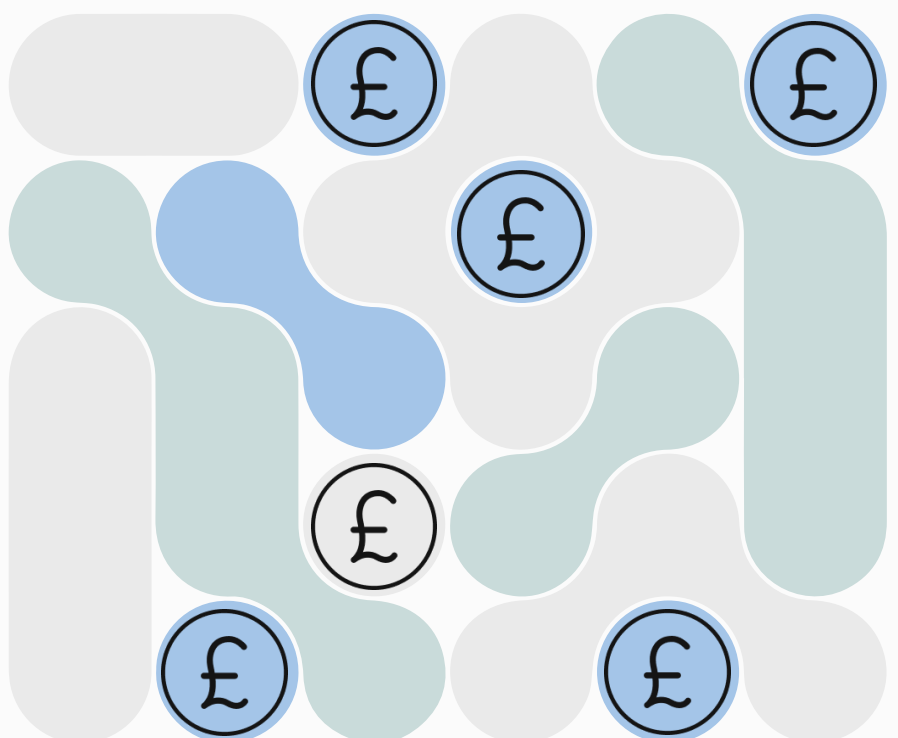


Evidence review: Peer review bias in the funding process

Main themes and interventions

March 2023

Dr Stefanie Schneider, Dr Cat Morgan, Dr Marion Hersh, Dr Clayton Magill, Professor Kate Sang and Professor Robert MacIntosh



About this report

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Acronyms

AHRC – Arts and Humanities Research Council (www.ukri.org/councils/ahrc/)

BBSRC – Biotechnology and Biological Sciences Research Council
(www.ukri.org/councils/bbsrc/)

CoI – Co investigator

DORA - Declaration on Research Assessment

EDICa – Equality, Diversity and Inclusion Caucus

EPSRC – Engineering & Physical Sciences Research Council
(www.ukri.org/councils/epsrc/)

ESRC – Economic and Social Research Council (www.ukri.org/councils/esrc/)

MRC – Medical Research Council (www.ukri.org/councils/mrc/)

NERC – Natural Environment Research Council (www.ukri.org/councils/nerc/)

R&I – Research and Innovation

PI –Principal investigator

STFC – Science and Technology Facilities Council (www.ukri.org/councils/stfc/)

1. Rationale and Purpose

This study examines recent literature about the impact of bias in reviewing and assessing processes for research funding from complementary perspectives, such as applicant, reviewer and decision-maker. A further aim is to explore strategies that have been used to improve the processes, whether they have been successful or not. The study's rationale is to improve understanding of existing biases, their impact and gaps in knowledge and practice.

The interventions in this report aim to combat bias and have been designed from our examination of the literature on bias in the peer review process for funding and wider reading of journal guidance documents and publishing processes. These can be applied across disciplines for various funders. EDICa suggests that any interventions introduced by funders are monitored to determine their success and that they should be openly reported on.

Research question: What reduces bias in the peer review process?

EDICa is a national project which aims to bring an intersectional perspective to the multiple disadvantages which can face marginalised researchers and innovators. EDICa's vision is to create inclusive research cultures enabling diverse researchers to access and thrive in careers across the research and innovation (R&I) systems, removing barriers to full participation experienced by women, disabled, LGBTQI and racially minoritized researchers, and researchers with caring responsibilities.

Creating inclusive research culture relies on practical, actionable and evidence-based insights that support diversity of individuals in key aspects of their careers. In this sense, an under-explored set of issues pertains to the processes of applying for and evaluating funding applications for research funds and the related processes of seeking publication in peer-reviewed outlets.

2. Executive Summary

- **44%** of the literature focuses on gender bias in the peer review process, half of which are from STEM.
- **18%** of the literature concentrates on racial inequity.
- **14%** of the literature examines institutional prestige.
- Bias impacts the funding process throughout various stages:
 - The funding call,
 - Preparing applications,
 - Preparing the review stage,
 - The review stage, and
 - Funding outcome.
- Groups of scholars affected by bias in the funding process are:
 - Women,
 - Early career researchers,
 - Disabled researchers,
 - Racially minoritized researchers, and
 - Researchers from less prestigious institutions.
- Internal barriers within institutions lead to fewer submissions for funding from these underrepresented groups.
- There is little evaluation of the interventions that funding councils used to counter biases, the reasoning behind them or their impact.
- Funders often rely on scholars' readiness to objectively evaluate their own bias and willingness to be objective.
- Advice or training to establish one's own views and/or to overcome harmful or self-reinforcing outcomes is scarce.
- Most funder guidance documents request that reviewers don't consider journal-based metrics as the only means to measure impact.

3. Methods

EDICa reviewed 50 published outputs about the peer review process for funding in academia and the innovation sector (outputs which had not been subject to peer-reviewed before publication were excluded from the study) for relevant content. We restricted our search to literature from the ten years between **2013** and **2023** to ensure explicit focus on the latest developments in the field and best practices.

A search of both peer-reviewed publications (including journal articles, conference submissions, pre-prints, etc.) was performed via Web of Science, Google Scholar and Google using the following search terms were used as Boolean operators: "peer reviewer bias language"; "peer reviewer bias north south global"; "peer reviewer discrimination"; "peer reviewer gender"; "peer reviewer prejudice"; "peer reviewer race"; "peer reviewer AND bias"; "peer review process bias prejudice"; "epistemic injustice AND peer review process"; "equality peer review process"; "equality grant peer review process"; and "inequality grant peer review process".

In total, 289 outputs were identified in this process; 151 were disregarded using exclusion criteria (detailed below) and 88 that focused on journals and publishing were reviewed separately and reported elsewhere. An additional 41 outputs were identified by searching for other authors' outputs and via "related articles" and 'cited by' features of Google Scholar or through the forward snowball technique, where new literature are identified through those cited or referenced, leaving **n = 50** outputs to be analysed herein. The number of citations for each item was recorded, if available, to ascertain the more widely disseminated narratives about peer review bias with respect to discipline.

Table 1: Number of outputs identified by discipline.

Discipline	Number	%
STEM	25	50
Medicine and Health	17	34
Humanities	5	10
Social sciences	3	6

Inclusion criteria for outputs: (1) focus is on bias in the peer reviewing process amid funding, grant, or journal review, (2) evaluation of the impact of bias during peer review, (3) presentation of strategies that have been used or suggest ways to mitigate bias in the peer review process concerning gender, race, lived disabilities, linguistic privilege or institution.

Exclusion criteria for outputs: (1) examination of bias in a specific field or discipline rather than specifically peer review, (2) discussion of differing peer review strategies with no mention of bias, (3) has not been peer reviewed itself (e.g., pre-print, book or chapter), (4) the output was published prior to 2013, (5) examination of the peer review process in the Global South, which falls outside of the scope of this evidence review.

We also reviewed a further 25 websites with links to publicly available handbooks, guidance notes for peer reviewers and panel chairs, and unconscious bias briefings by the AHRC, BBSRC, EPSRC, ESRC, MRC, NERC and STFC for EDI guidance. We also studied published UKRI diversity data between **2014 and 2021**, due to availability, and examined action plans from respective research councils for EDI interventions. Innovate UK and the British Academy did not share any comparable documents on their websites. Indeed, though the British Academy mentions EDI efforts in their Strategic Plan for Innovate UK, no data is available yet.

4. Key Findings

In the following sections, findings are organized by the 5 stages of the funding process (see **Figure 1**), where evidence is presented, actions taken by research councils are examined, and gaps in the literature are identified. The gaps arise both within established debates on bias and represent new and emergent themes. The 5 stages of the funding process focus on of the main debates or themes identified across the literature and funder guidance, from the design and circulation of the funding call to the decisions making process in the final funding outcome.

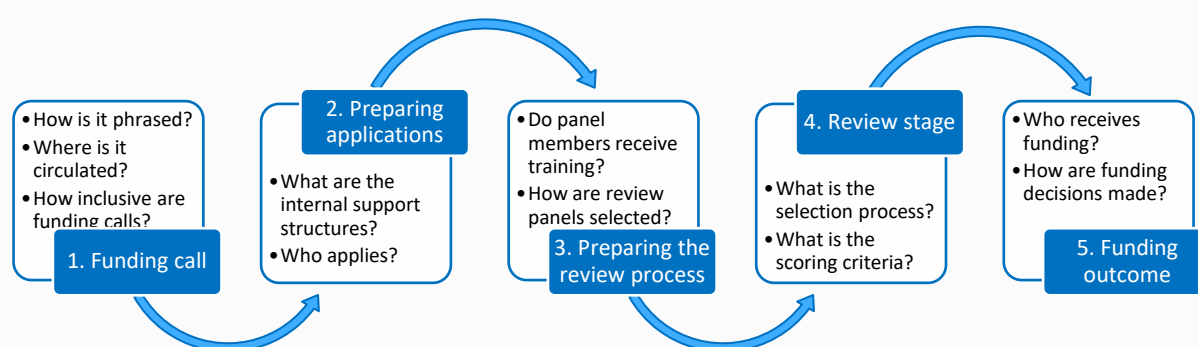


Figure 1: 5 Stages of the funding process

Further, two heat maps (see **Appendix and B**) were created to demonstrate at what stage in the funding process various biases come into play – according to the literature and funder documentation we reviewed. The heat maps also show relationships between multiple and sometimes overlapping biases at different stages of the funding process. Darker shading in the heat map represents greater numbers of articles or documents about or discussing these issues, and lighter colours represent fewer articles or documents.

Section 1 - 4 is structured as follows: we briefly introduce key questions of each section first, and then outline evidence that has been found in the research literature ("Evidence for issues"). Evidence found usually outlines issues and obstacles faced by specific groups of researchers and calls for interventions to achieve change. A separate section is then dedicated to

those actions (“Proposed and planned actions”). It reviews what actions and interventions are called for, whether there is any evidence for their effectiveness and whether funders within the UKRI, British Academy and Innovate UK have tested or have announced intentions to test these interventions. Lastly, each section ends with “Gaps in Research”. Here it is outlined which issues have not yet been addressed in research and policy documents by funders. Section 5 reviews statistics relating to who receives funding without repeating interventions that aim to change the current imbalances.

4.1 Funding call

The literature reviewed for this section focuses on the funding call itself. This includes how the funding call is circulated, as well as how it is worded to appeal to particular research communities. This section outlines evidence for inclusive and exclusive wording in funding calls, and actions taken to make funding calls more inclusive. It highlights gaps in research for the following areas:

4.1.1 Evidence for issues

A review of the literature has highlighted two areas with EDI issues:

- (1) **The wording of eligibility criteria in a funding call directly impacts who decides they are eligible to apply.** For example, job rank and employment criteria have negative connotations for women, who are more likely to be on fixed-term contracts than men due to academic employment practices, creating a gender disparity even at the application stage (Cruz Castro and Sanz Menéndez 2020). Parallels can be drawn to research on recruitment practices, which have investigated the use of gendered language in job advertisements that discourage women from applying (see: Gaucher et al. 2011; Sczesny et al. 2016; Yavorsky 2019).
- (2) **Bias against methods and research designs rooted in the Global South.** Koum Besson (2022) for example presents a process for conducting an epistemic injustice analysis of funding schemes using a decolonial lens. In this context, the concept 'epistemic injustice' refers to being unfairly disadvantaged due to gap in research councils understanding about healthcare in diverse settings and populations (see: Fricker 2007). Koum Besson argues that there are additional challenges in global health funding due to unequal power dynamics, rooted in coloniality. For example, the aim of call for proposals that aim to address "gaps in the literature" can clash with the focus of projects from the Global South that examine diverse social structures that disadvantage communities. Funding calls and review panels should consider that some proposals are rooted in local perspectives and may not produce knowledge that is easily transferable to Global North settings. Therefore, applicants from the Global South should not be disadvantaged by call for proposals aim, language or eligibility criteria (Koum Besson 2022, p.2)

4.1.2 Proposed and planned actions

Scholars have called for the wording of calls for proposals to be updated, reviewer guidelines and guidance documents to use objective and non-gendered language to describe the ideal candidate to address gender equity in the application and selection process (Magua et al. 2017; Alvarez et al. 2019; Cruz Castro and Sanz Menéndez 2020). Criteria asks reviewers to rate and recommend an applicant based on predetermined gendered phrasing, creating a potential source of bias, discourage women from applying and being awarded funds. For example, phrases

associated such as "leadership potential" can be changed to "promise to make significant contributions", "importance" to "influence", "innovation" to "originality" and "creativity" to "inventiveness" (Alvarez et al. 2019). Guidance should also outline that reviewers consider an applicant's research record, avoid and references to personal circumstances irrelevant to the award.

In response to criticisms that funding platforms and single calls were either complicated to navigate or not designed in an inclusive manner, the UKRI launched the Simpler and Better Funding (SBF) programme. As of December 2023, 16 pilots of funding calls across a range of disciplines have been launched. UKRI have further made their websites more accessible and continue to carry out user testing. On said website are also more guidance documents available on how to apply for funding. We could not yet find evidence for the effectiveness for these measures.

Some councils have announced a review of the language used in funding calls in the context of the UKRI SBF programme. The EPSRC Action Plan lists improving the use of "plain English" in funding calls as one of its actions in progress that ensure fair access to funding (2022a, p. 17) and the BBSRC stated in their Action Plan that they would review the language use in published documents, like funding calls and panel guidance, as well as provide support for panel chairs to foster the use of inclusive language during meetings to ensure "diversity is incorporated at the design phase" (2022, p. 10). There are no further details publicly available at the time of writing.

4.1.3 Gaps in research

Studies relevant to the language use in funding calls focused heavily on gender bias. Inclusive language use regarding other protected axes of inequality that would encourage applicants who might otherwise not feel addressed by funding calls and their outlined eligibility criteria. We furthermore expected to find research that examined how scholars with disabilities experience the application process.

In their strategy plans (British Academy) and Action Plans (UKRI councils), funders stated that they aim to "[reach] out to and [draw] in more diverse people, knowledge and ideas" (British Academy, 2023). British Academy refer to a scheme that supports researchers working directly with the Foreign and Commonwealth and Development Office, and UKRI councils mention deliverables like the AHRC Indigenous Engagement Programme. There is no explicit statement in any document on efforts to promote funding for methods and approaches not rooted in dominant research traditions in the Global North. There is also no evidence as yet that initiatives systematically fund projects that go beyond international

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development studies. While more diversity in research panels is a desired goal across funding councils and should create more openness towards innovative research designs (see 4.3), no evidence as of yet confirms that this is the case.

4.2 Preparing applications

Data on funding outcomes have shown lower funding rates amongst women (Steinþórsdóttir et al. 2020), ethnic minority researchers (Zimmermann et al. 2022) and disabled researchers (Swenor et al. 2020). One contributing factor to this is that researchers with protected characteristics are less likely to submit funding proposals at all and when they do, they consistently apply for smaller grants than white male researchers (EPSRC, 2022a). Institutional factors that limit self-selection as well as internal selection will be reviewed in this section.

4.2.1 Evidence for issues

For this evidence review we have found evidence for the following key issue:

1. "The best" don't always apply (Cruz Castro and Sanz Menéndez, 2020). Women, ethnic minority researchers and scholars with disabilities are less likely to apply for large grants as they are underrepresented in senior, permanent roles in which they have access to the resources required to competently respond to funding calls in a leading role (UKRI: Detailed ethnicity analysis of funding applicants and awardees 2015–2016 to 2019–2020; EPSRC Gender Diversity in our Portfolio: Survey Findings and Interventions; UKRI diversity data for funding applicants and awardees, 2020–2021 update).

Gender

Internal structures create nascent barriers. Women are under-represented in senior roles that would allow more dedicated time to research (AdvanceHE, 2020a). The reasons for this are complex and can be studied in more detail¹ here. Directly relevant for this review are the findings that both women and men in academia expect women to carry out more voluntary, less respected work that prevents them from investing more time into research and grant writing (Roper 2019).

Gender bias impacts the additional responsibilities that women are allocated in academia. "Institutional housework" such as advising students and mentoring colleagues help universities to function but consume time that could otherwise be used to apply for grants and write research articles (Sümer and Eslen-Ziya 2023).

Applying for funding seems to be a chicken-and-egg problem: Historically lower success rate contributed to a culture in which women are less likely

¹ See: <https://www.advance-he.ac.uk/guidance/equality-diversity-and-inclusion/employment-and-careers/women#overview> and <https://www.advance-he.ac.uk/guidance/equality-diversity-and-inclusion/employment-and-careers/women#overview>

to apply for funding at all (Lee et al. 2013; Kaatz et al. 2014). Applying for funding seems to be a chicken-and-egg problem: Historically, lower success rates contributed to a culture in which women are less likely to apply for funding at all (Lee et al., 2013; Kaatz et al., 2014). Award rates for women in the role of PI and Col have been equitable with the award rates for men in recent years within UKRI. Even so, in absolute numbers, this apparent parity nonetheless means considerably fewer women-led funded research projects due to a large discrepancy in application numbers: two-thirds of all applications are still led by men (UKRI 2021a). While UKRI diversity reports during 2014 – 2023 show an increase in funding applications from women and ethnic minority academics, the lower proportion indicates that institutional support structures and internal pre-selection processes still favour applicants who are white men.

Race and ethnicity

Findings show a connection between the PI's race and ethnicity and research proposal award rates in STEM. Zimmerman et al. (2022) analysed $n = 14,263$ biomedical research proposals from the University of Michigan Medical School, measuring the submission and award rates across racial and ethnic groups (Asian, Black / African American, Hispanic / Latino) to ascertain which groups are disadvantaged by the submission process. For example, Black or African American PIs have the lowest submission rate, and when they do submit proposals, funding is awarded less frequently (Zimmermann et al. 2022, p. 9). Due to this experience of racial disparity in award funding, some lead researchers or principal investigators have begun to adjust their proposal submission strategies to compensate, such as being selective about the submission category to use (industry, non-profit, or government) (Zimmermann et al. 2022).

Institutional prestige

Successful funding applications are more often submitted by scholars employed in prestigious and research-intensive institutions. Working in such an environment may confer systemic advantages in the form of establishing and maintaining a network with other experienced PI and Col colleagues, receiving feedback from such experienced colleagues, and resources, expertise and support in writing proposals e.g. from dedicated grant offices (Besselaar and Mom 2022; Hassell 2021; ESRC 2020).

4.2.3 Proposed and planned Actions

Transparency

Scholars demand that funders should regularly publish statistics on success rate, race and ethnicity, accompanied by reviewer gender, geographic

location, career stage and funding status to ensure full transparency (Taffe and Gilpin 2021). The UKRI and councils have complied with the release of the following documents:

1. Competitive funding decisions <https://www.ukri.org/what-we-do/what-we-have-funded/competitive-funding-decisions/>
2. Diversity data for funding applicants and awardees 2020-21 <https://www.ukri.org/publications/diversity-data-for-funding-applicants-and-awardees-2020-21/>
3. Research council funding: diversity data, financial year 2020 to 2021 <https://www.ukri.org/publications/research-council-funding-diversity-data-financial-year-2020-to-2021/>

Full transparency is not an unambiguous goal – the data collected and displayed in these reports is a starting point, but further research is needed to establish which categories are still overlooked or may need to be changed to offer a more accurate representation.

EDI plans as requirements for successful bids

Across all councils, it has been acknowledged that effective EDI measures require holistic, long-term action. Many councils plan to make substantial EDI plans a requirement for funding. There, as yet, no evidence of how such EDI plans change the impact or structure of funded projects and how EDI plans are weighted in the evaluation process. Funders also need to provide sufficient guidance on what a strong EDI plan looks like which is available for all applicants.

Intervention: Narrative CV

One intervention for funding applications within the UKRI is the R4RI: Resume for Research and Innovation. According to the UKRI website, the narrative CV sits halfway between a traditional CV and a cover letter, allowing scholars to promote a wider range of skills. This aims to boost the success of researchers who have not yet built a portfolio that would stand out in traditional application forms. The ESRC announced that a pilot would be launched in 2023, with updates pending.

While we have not found evidence at the point of writing that narrative CVs reduce bias, it is important to note that applicants can only benefit from this format if their writing skills are strong. Studies have demonstrated that panels don't objectively assess the quality and originality of a proposed project but that they can be swayed by the way information is presented, e.g., degrees of readability and analytic writing, complexity

and confidence of the author in their abilities and the project (Besselar and Mom 2022).

Besselar and Mom (2022) found that applicants who can skilfully combine analytical writing with a better narrative structure score higher. Alongside the personal competence at this particular form of writing there are likely to be additional, intersectional effects where English is not an applicant's first language and/or where accessibility issues or neurodivergence conditions are involved. To increase their chances of success, scholars need to become proficient in a particular writing style for their CVs and proposals, often achieved through internal support, like grant offices, which could in turn again disadvantage scholars without access to such mentoring, advice and editorial support.

Mentoring

Some research councils have launched schemes in their Action Plans that, for instance, offer mentoring opportunities to Early Career Researchers independent of their institutional affiliation (e.g. AHRC New Generation Thinkers, EPSRC New Investigator Award). However, associated beneficiaries are usually scholars who have already submitted successful bids. Such training opportunities on a council level for scholars who have not yet been successful in securing funding could benefit scholars from smaller and medium-sized universities.

4.2.4 Gaps in research

Interventions focused on mitigating bias in the review process will struggle to address the lack of applications from under-represented communities if the causal mechanism lies at the application stage rather than the review stage. EDICa should consider examining how certain academic, institutional and cultural conditions might be built into funding calls, encouraging institutions to review their internal structures.

We expected to find literature that outlined barriers linked to identifying suitable funding calls. This includes challenges for scholars who have not received mentoring on how to design funding projects and how to tailor one's expertise and ideas to a funding call. We expect that this applies especially to scholars from institutions that lack resources to support their staff in building networks through which collaborations could be established (e.g., conference attendance and research events), and those who have not been mentored on how to write a research bid in the UK. Mentoring can act as a catalyst for career development, as it shows academics how to build a meaningful network and how to develop their research further (Ambler, Harvey and Cahir, 2016). It is arguably similarly subject to bias as decisions to hire and promote. It is a human tendency to

trust and support those who remind us of ourselves, which leads to the perpetuation of existing power structures. We did not find research that examines whether senior academics tend collaborate with early career researchers that share key social characteristics with them, and how this affects which early career researchers are investigators on successful funding bids.

We also did not find literature that looks at enablers to identifying and applying for suitable funding calls. Institutional structures like mentoring programmes enable early career scholars to develop and collaborate on ideas that are competitive in funding calls. Knowledge of how to write a research bid and what funding calls one is eligible for is taught, and scholars who are at institutions that are part of the Russell Group or "the golden triangle" benefit more from internal support structures and networks than scholars from other institutions. There is also, as yet, no work exploring the effect of being part of institutions which actively seek "research excellence" for example, on the confidence, willingness to apply or sense of entitlement of scholars to funding and whether this consequently impacts on the quality of funding applications.

4.3 Preparing the review stage

This section focuses on how the assessment of research proposals and applications is prepared and set out. As review panels are the most commonly used model of assessment for grant applications, the key questions we seek to answer here are the following: How do EDI concerns affect the panel selection and reviews, what guidance do panel members receive and how effectively is such guidance enacted?

4.3.1 Evidence for issues

Scholars across disciplines have pointed out weaknesses of review panels in funding decisions (Bianchini et al. 2022; Fang and Casadevall 2016; Loehkivi, Velbaum and Eigi 2012; De Peuter and Conix 2022; Recio-Saucedo et al. 2022). Scholars share concerns regarding the reliability, responsibility and validity of the process (e.g., Bessler et al. 2018 for short summary). Very little time to discuss each proposal leads to "fast heuristics", and the results of how single panel members evaluate how a proposal meets assessment criteria varies greatly, depending on their area of expertise, but also depending on biases they hold. While scoring will be discussed in the next section, two factors that can impede or promote fair assessment were found to be relevant in the planning stage of the assessment:

- 1.) **Diverse panels.** A panel's makeup impacts the arguments that reviewers make when assessing proposals, the depth of discussion about assessment criteria, and the focus is on the perceived social impact of the submitted proposal (Abma-Schouten et al. 2023). Reviews from diverse panels (including non-scientific peers) described broader and more concrete impact topics and further connect the research processes and the characteristics of applicants with impact creation more frequently (see: Luo et al. 2021). Scholars therefore call for a reviewer pool that purposefully includes diverse voices to address racial disparities in the grant funding process (Stevens et al. 2021) regarding the geographic distribution, gender, race, ethnicity and career stage.
- 2.) **Anonymity.** There is some evidence that this intervention could be effective: A team of researchers funded by Women in STEM Ambassador Australia have led a trial across four cross-disciplinary research entities and found that especially early career researchers and women benefitted from this measure (Kingsley et al, 2023). This topic is otherwise more prevalent in publishing, but concerns funding applications for similar reasons. While journals outline different types of peer review in their guidance documents (single-blind, double-blind, open), neither completely anonymous nor

transparent processes are clearly generally favoured (APA 2021). While there is evidence that open reviews benefit famous authors and anonymous reviews reduce bias (Tomkins et al. 2017; Darling 2015), journal editors argue that anonymising applications completely would not always work as colleagues would still recognise each other within a specific field (Elsevier 2017). For funding applications, anonymity could reduce disadvantages for applicants from less prestigious institutions, or who have protected characteristics that assessors are historically biased against. Diversity reports indeed show that an increasing number of applicants do not disclose their gender or ethnicity (UKRI 2021a).

- 3.) **Training.** Some authors posit that training reviewers is critical to addressing individual bias, rooted in conscious or unconscious bias (Witteman et al. 2019) before they are asked to evaluate funding proposals. More generally, that bias awareness training is available to reviewers during this preparatory stage (Glasman and Albarracín 2006; Paluck and Green 2009; Chang et al. 2019).

4.3.2 Proposed and planned Actions

Diversity in panels

Scholars suggest that including non-scientific peers in review panels (end users or societal stakeholders) can create a wider range of arguments (Abma-Schouten et al. 2023). Review panels could also include the target audience, such as patients and policy makers, to ensure that societal impact has more relevance (De Peuter and Conix 2022 see: Bedessem 2020; Fleurence et al. 2014).

The publishing sector may offer some ideas and perspectives that could be helpful for finding competent assessors across different career stages and with various backgrounds: In publishing one common measure is to flag newly accepted authors from underrepresented regions as new reviewers and offer free reviewer training that automatically adds those who complete it to the reviewer base (Eve, Mehmani, and Wilson 2021b). Publishers also offer tools like the "Editorial Manager's alternative reviewer", which can help link reviewers with underrepresented identity markers with those from majority groups. One key limitation of such tools is that they are biased towards more senior academics (Eve, Mehmani, and Wilson 2021c). Another intervention in publishing is to ask authors to recommend reviewers, which leads to more positive review outcomes, potentially due to bias (Eve, Mehmani and Wilson 2021c).

In councils that struggle with low participation of female researchers, such as the EPSRC, review panels have a target of 30% of women panellists

(EPSRC 2022a). Several councils added to their Action Plans that successful grant applicants for Early Career Researchers would act as reviewers in future calls (e.g., EPSRC New Investigator Award holders). Unsuccessful applicants who scored highly could be invited to review future applications, too. Further research on the impact on whether a more diverse cohort receives funding as a result of these new benchmarks is needed.

Guidance for reviewers

While we were not able to confirm what, if any, EDI training reviewers receive ahead of joining a review panel, written EDI guidance for reviewers is at times publicly available. Out of the six funding councils within UKRI, two councils explicitly address EDI in guidance documents for reviewers, with a strong focus on unconscious bias and examples for biased feedback. In guidance documents of the other four councils' reviewers are asked to treat everyone fairly, check their biases, report conflicts of interest, and act ethically in all documents. Reviewers must usually adhere to the Equality Act and the Seven Principles of Public Life. Some documents provide a link to a research council's Equality and Diversity Policy. In response to the pandemic, reviewers are reminded that COVID-19 had an unequal impact of applicants' track records. There may be further EDI guidance that is not publicly available.

The two aforementioned councils which have shared unconscious bias guidance are STFC and MRC. The STFC Unconscious Bias Briefing outlines four examples of studies from the early 2000s which argue that gender bias affects the way CVs, auditions, funding applications and reference letters (STFC, 2014). It then offers four bullet points on overcoming unconscious bias (ensure evaluation criteria are clear, sufficient time is allowed, the entire application is considered, and that one can defend every decision against evaluation criteria). It ends with an explicit commitment of the council to eliminate discrimination. The MRC's "Tackling Bias in Peer Review Guidance" offers five pages of content. A figure highlights different peer review biases during the peer review process. It provides specific examples of sources of bias and how they affect how a reviewer evaluates an application. Issues mentioned are institutional and individual prestige, disability and language barriers. The effectiveness of unconscious bias training is disputed (see 4.3.3), and there is no evidence on whether reviewers feel more equipped to recognise, challenge and overcome biases when they receive guidance documents that they are asked to read in their own time.

Anonymity

EPSRC plans to trial fully anonymised peer review for funding calls 1 and 2 of New Horizons (2022a). While these trials have been planned but not yet executed, no evaluation of this intervention is available at the time of writing.

Training

Recio-Saucedo et al. state that training reviewers on assessment criteria could reduce bias and increase consistency in panel decisions, although this would need to be tested (Recio-Saucedo et al. 2022, p. 12). Recio-Saucedo et al. (2022) refer to a randomised controlled trial tested by Sattler et al. (2015), where reviewers were shown a short training video on why it is important to read and understand the funder's criteria, defining review criteria and how to use rating scales to assess it (Recio-Saucedo et al. 2022, p. 17). Findings showed training significantly increased reliability for both new and experienced reviewers who spent more time reading the grant review criteria, further increasing evaluation score accuracy. Exploring the mode of delivery (e.g., written guidance, a short video, an online course/quiz) would be a promising area for further research but not one which we found in our evidence review.

Belz et al. suggest that the innovation sector trains peer reviewers to reduce the use of status characteristics in their evaluation, ensure that track records are weighed equally and include awareness of gendered language in proposals to mitigate lower evaluation scores (2022, p. 274). Belz et al. (2022) argue that introducing this intervention to address gender bias could increase funding for women in the innovation sector.

4.3.3 Gaps in research

In our systematic review we found no studies that offered empirical evidence that reading texts on unconscious bias reduces bias.

Unconscious bias training is similarly not a guarantor for changing behaviour: A meta-analysis of almost 500 studies on unconscious bias training suggests that many formats of this type of training are not effective (Forscher, Lai, Axt and Ebersole 2019).

Training that offers exercises to determine what types of biases one has and concrete strategies to overcome them are most likely to be effective (Gino and Coffman 2021) but would mean that panel members would have to invest more time into training. Further research in effective EDI training methods for the research process is needed.

Review stage

This section is dedicated to the peer review process. Scholars have identified several aspects of it that make it susceptible to putting vulnerable groups at a disadvantage. This includes ambiguous scoring criteria, evidence for reviewer bias towards "prove it again groups" that remain unchallenged, as well as the aim of panels to find weaker proposals instead of seeking excellence.

4.3.4 Evidence for issues

The following aspects of the peer reviews of funding proposals received particular scholarly attention:

1. **Ambiguous scoring criteria:** Several experiments and studies have highlighted in the past that the same proposal can receive significantly different scores, depending on who sits on the panel (overview by Roumbanis 2019). This is due to multiple factors, like subject expertise, bias and interpretation of the scoring criteria. The latter will be discussed in view of EDI concerns.
2. **Seeking reasons to reject instead of seeking reasons to fund:** Studies show that peer review panels seek subjective rejection criteria to reduce the pool of eligible candidates instead of seeking out research excellence (Bessler et al. 2018),
3. **Bias:** The impact of bias towards several protected characteristics has been explored in the quality of feedback that applicants receive as well as in the scores for their proposals.

Ambiguous scoring criteria: Characteristics of the reviewer

There are gendered differences in how scoring criteria are applied to grant proposals by men and women reviewers. Severin et al. (2020) examined the impact of the corresponding gender of reviewer and applicant, finding that men gave higher scores to proposals by men, weighing the applicants' experience and track record higher as compared to comparable women applicants. Yet, the same phenomenon does not apply to women reviewers of women applicants (2020, p. 7). As Tamblyn et al. (2018) put it:

"When combined, reviewer characteristics can have a substantial effect on an application's score and its likelihood of funding. In the worst-case scenario, an applicant who has female reviewers only, no conflicts on the committee, disagreement in the quality of the application by the reviewers, and reviewers with less expertise in the domain may receive a score 0.5 points lower on a 1 to 4.9 scale. A

difference of this size could move an application with a fundable score of 3.9 to a non-fundable score of 3.4."

In addition to gender, experienced reviewers can overestimate their understanding of scoring criteria, basing their interpretation of, and reliance on, previous experience. In contrast, less experienced reviewers may not fully understand the criteria and scoring system (De Peuter and Conix 2022). As reviewers are invited to panels due to their relevant expertise, it needs to be considered that characteristics beyond this subject expertise may affect the way they evaluate a proposal.

Ambiguous scoring criteria: Research from the Global South

In the event "Peer-reviewing Global South papers: EDI and identifying blind spots" hosted by *The Sociological Review*, the event chairs shared issues that Global South scholars face in publishing and funding. One is the expectation to apply frameworks and concepts from the Global North to analyse social structures and norms of the Global South, and deviating from this is often evaluated as "unscientific". Topics like health systems are deeply rooted in local perspectives and might not be "robust" enough to develop interpretive tools that apply to them (Koum Besson 2022). The same applies to writing about racism and inequalities: writing about these topics requires substantial emotional labour, which, again, refers to reviewers from the Global North as angry or unscientific. Scoring criteria don't appear to account for the strong preference for dominant research designs, even though most funding calls seek innovative proposals.

Bias: Gender of the applicant

The main body of literature here focused on the significant bias that women experience as their proposals progress through peer review stages. Evaluators rely heavily on gender as a status characteristic unrelated to the applicants' capabilities (Belz et al. 2022, p. 257). Bias exists when reviewers make a judgment based on an applicant's gender, which leads to inferences regarding their competence, rather than using an impartial evaluation process that assesses their ideas and past performance. The impact is that fewer women apply for funding, and when they do, their legitimacy is questioned. The result is that gender bias is entrenched in the peer review process.

Studies show that grant reviewers require more proof of ability from women applicants, who must have more than *twice* as many publications and prestigious awards to earn the same competence score as comparable men applicants (Kaatz et al. 2014). The implications are that women are disadvantaged by the burden of proof needing to be twice as demanding as that expected of male colleagues amid the peer review

process. Scoring criteria like "impact" are interpreted differently, depending on the identity of the applicant.

Panel members are further instructed to score the PI and the project independently, but scores show that most panels don't distinguish between one and the other. The grant application system and review criteria centres around publications, recognition, leadership and funding history, which gives men an unfair advantage over women (Witteman et al. 2019). For example, reviewers require more proof of ability from women applicants, who must have more than twice as many publications and prestigious awards to earn the same assessment of competence as men (Kaatz et al. 2014). The implications are that women are disadvantaged by the burden of proof and need to be twice as good as their male colleagues.

Reviewers evaluating the PI using these criteria view women negatively. When reviewers assess the quality of an application only, rather than the calibre of the principal investigator, there are no gender differences (Witteman et al. 2019). One example for this is a study by Mutz et al. (2015) that shows that research proposals submitted by women to the Austrian Science Fund were rated less favourably than those submitted by men (Mutz et al. 2015). This impacted the final decision on whether a proposal is funded. A further example is renewal grant applications submitted to NIH, where criteria are associated with leadership and achievements; women are deemed less competent and scored lower against these criteria (Kaatz et al. 2016).

Gendered feedback affects how applicants view the objectivity of the funding evaluation process, peer review in academia in general, and perhaps more importantly, their future career decisions. The language in reviewer reports is indicative of a negative bias in the panel deliberation and decisions towards women applicants (Kaatz et al. 2014, 2016; Magua et al. 2017; Van Den Besselaar et al. 2018; Van Den Besselaar and Mom 2022). Reviewers are "negatively sensitive" to the gender representation of research teams, evidenced by language patterns in reports that are unfavourable for research teams with a high number of women in them (Bianchini et al. 2022, p. 5).

Reviewers use gendered language in evaluative feedback, suggesting an implicit bias where men are viewed as leaders and, therefore, are more fundable. Examples typically associated with men describe them as "aggressive, competitive or risk-taker" (Kaatz et al. 2014) with "highly innovative" and "highly significant research" (Magua et al. 2017), whereas women are characterised as "helpful" with "extensive expertise" (Magua et al. 2017), 'supportive or nurturing' (Kaatz et al. 2014).

Women further receive more extensive reports than men, containing more negative comments on average, many focusing on "personal

competence" (Zimmerman et al. 2021, p. 1417), and some are "direct attacks" (2021, p. 1419). Whereas comments aimed at men tend to focus more explicitly on the proposed research project.

Bias: Geography and linguistic privilege

Evidence suggests that barriers experienced by marginalised groups are so far not minimised during the peer review stage in the research process. In publishing, which is equally relevant to academic career stage progression and similarly heavily relies on peer review, demographic bias based on "author gender, geography, institution, race or other demographics" (Smith et al. 2023, p. 512) is worse for researchers affiliated with research institutions in non-Western countries, whose primary language is not English or based in countries with low Human Development Indices. Further, researchers from lower-income or non-English-speaking nations are more likely to be invited to resubmit during the next round of funding and to receive lower scores from reviewers.

Bias: Race and ethnicity

One major issue discussed in the extant literature is the lack of funding for Black scientists conducting research on public health and medicine. Erosheva et al. posit that disparities are driven by preliminary criterion scores, which, on average, are worse for Black investigators across all five criteria used by the National Institutes of Health (NIH) —significance, investigator(s), innovation, approach, and environment (2020 p. 9).

4.3.5 Proposed and planned actions

Modified lottery

The intervention to (partially) replace peer review panels that appears to have received the most attention in the academic literature is that of a lottery mechanism. Scholars argue it would counteract several issues ascribed to review panels, like bias and scientific conservatism (Roumbanis 2019). It could also make the application process less time-consuming for applicants and reviewers, freeing up more time to conduct research (ibid.). Several studies show that panel members evaluate the same proposal very differently, weakening the argument that a panel's expertise leads to selecting the objectively strongest projects (Roumbanis 2019; Besselar, Sandstroem and Schiffbaenker 2018). So far, these advantages are only hypothetical, as there is no evidence yet on the effects of this method.

The process would be the following: a modified lottery system for funding allocation could exclude researchers without sufficient experience and

reject proposals that fall short of expectations (Fang and Casadevall 2016; De Peuter and Conix 2022). Mid-level proposals that do not meet the minimum criteria could then be revised and resubmitted in the next round of funding – leaving a high standard of applications for the lottery (Fang and Casadevall 2016; De Peuter and Conix 2022). Fang and Casadevall (2016) suggest a two-tier system where (1) highly ranked proposals are identified by peer review and (2) funding decisions are made based on a randomised computer lottery system (2016, p. 4). Outstanding proposals selected via the computer-based lottery would be awarded funding, dependent on the research budget and order of priority. British Academy have started to trial a lottery for the final stage of funding application assessments with an evaluation still outstanding.

DORA declaration

The DORA declaration refers to the San Francisco Declaration on Research Assessment. Most councils refer to it in their guides for reviewers. Signatories of the declaration follow several practices in the assessment of research outputs like the rejection to use journal-based metrics and to consider the value of a broader range of impact measures.

We don't know how helpful panel members find the DORA declaration. Peer review guidance documents don't outline what other impact factors would be crucial for particular funding calls. It is also unclear whether the stated commitment to the declaration achieves that publication metrics do not affect the panel's decisions.

Training on feedback and bias

Bias interrupters offers a toolkit for performance evaluations that could be adapted for the peer review process in publishing and grant applications. The toolkit highlights what review patterns can highlight an EDI issue and how a review can be structured to make it less prone to bias). The toolkit goes beyond typical unconscious bias training as it is based on authentic examples for a particular task and offers advice on how to overcome bias by offering advice on how to change language that is used for said task. It for instance lists phrases that are more common with men versus "prove it again" groups and highlights these differences' effects. Data suggests that men tend to be evaluated on their potential, whereas other "prove it to gain groups" are judged based on their performance. An intervention to address this is to discuss potential and performance separately in a review (Center for WorkLife Law 2021). Another intervention is to address personality and performance in separate sections of the review and create criteria that facilitate that specific feedback is given systematically. Without these, "prove it again groups" receive less concrete feedback highlighting how to improve (ibid.).

Update the wording of reviewer guidance to ensure that applicants' research record is discussed, avoiding mention of their age, gender, work-life balance, care responsibilities or other responsibilities outside of their research role (Magua et al. 2017; Cruz Castro and Sanz Menéndez 2020).

Reviewer guidance documents lack concrete examples of what a biased review looks like. A list of examples could be used as a checklist for panels to ensure their feedback is consistent for all applicants.

4.3.6 Gaps in research

We found no studies that analysed how constructive reviewer feedback can help applicants improve their proposals. Rather the focus is on improving the consistency and quality of feedback, specifically that non-gendered language be used (Kaatz et al. 2014; Zimmerman et al. 2021). There has also been the introduction of multiple rounds of feedback at various stages through the application process (Recio-Saucedo et al. 2022).

Funding outcome

This section summarises statistics on current funding outcomes. As the aforementioned proposed and planned actions all have the aim to change the current funding outcomes, planned and proposed actions are not outlined.

4.3.7 Evidence for issues

Academic position

Academic position and career stage are important in determining who receives research grant funding. Most funding awards go to academics who hold senior positions, such as professorships (Steinþórsdóttir et al. 2020). Further, career progression correlates with successfully procuring prestigious grants, which in turn influences recruitment, hiring and promotion opportunities and thereby perpetuates existing power structures (Van Den Besselaar and Sandström 2015).

Institutional prestige

There is a parallel between funding success rates and institutional prestige; researchers affiliated with prestigious institutions are more likely to receive funding (Lee et al. 2013). Further, funding success is lower for applicants from medium and small institutions compared to larger institutions (Murray et al. 2016, p. 6), potentially indicating that proposals from these

institutions are under-evaluated.

Gender

Men typically receive more funding and high-status awards than women (Head et al. 2013; Boyle et al. 2015; Witteman et al. 2019; Steinþórsdóttir et al. 2020). On average, for every woman professor awarded a grant, a man receives two to three with higher amounts of funding (Steinþórsdóttir et al. 2020). As mentioned previously, women applicants are also under-represented in the number of proposals they submit (UKRI 2021a, 2022). This is representative of a 'leaky pipeline', a phrase commonly used to describe the representation of women in STEM careers, and specifically those in senior positions (Advance HE, 2020b).

Research grant funding systems are conditioned by 'gendered power relations in academia' that decidedly preserve existing conditions favouring men and male-dominated fields (Steinþórsdóttir et al. 2020, p. 363), such as science and technology (Kaatz et al. 2014). Further, although there has been an improvement in the number of women researchers funded in STEM, like the National Institutes of Health (NIH), Safdar et al. argue that progress is slow compared to the number of doctoral students, which will only increase (2021, p. 7). The authors suggest that future research consider whether fewer women are applying for funding from NIH or if applications by women are more likely to be unsuccessful.

Ethnicity and race

The summary of UKRI diversity reports from 2014 – 2020 show that figures for minority groups have very little year-on-year changes (UKRI 2021a). The benchmark if the Higher Education Statistics Agency (HESA) for PI and Col awardees from ethnic minorities is the academic staff share across Higher Education. The share of PIs from Chinese ethnicity exceeds this benchmark, but all other ethnic minorities remain below the benchmark, though with a slight increase for both roles.

Several investigations have focused on the NIH grant system and the racial disparities in who is funded by them (Azoulay et al. 2013; Lindner and Nakamura 2015; Forscher et al. 2019; Erosheva et al. 2020; Stevens et al. 2021; Taffe and Gilpin 2021). One major issue discussed in the extant literature is the lack of funding from the NIH for Black scientists (Azoulay et al. 2013; Lindner and Nakamura 2015; Forscher et al. 2019; Erosheva et al. 2020; Nakamura et al. 2021; Stevens et al. 2021; Taffe and Gilpin 2021). Stevens et al. (2021) created a network of women from biomedical engineering from all academic stages and roles to address racial injustice in academia.

Similarly, Taffe and Gilpin (2021) identify that Black principal investigators are less likely to receive funding than proposals submitted by white PIs. The impact of disparities in grant funding is the limitation of career progression of Black researchers and others from underrepresented backgrounds, who are less likely to receive a tenure-track position or be awarded tenure – impacting the likelihood that they will be awarded funding (Stevens et al. 2021; Taffe and Gilpin 2021).

Disability

Disabled researchers are disadvantaged if they disclose their lived experience with disabilities and, as a result, are less likely to receive funding. Evidence from a US-based funder shows that the funding rate declined significantly over ten years (2008–2018) for researchers who were open about their status (Swenor et al. 2020).

For example, lezzoni (2018) wrote a reflective piece about their experience of disability bias after receiving inappropriate and offensive comments from a peer reviewer about the validity of the research team's chosen methods and competency, indicating that there is a bias against disclosing lived experience with disabilities as a researcher.

Overall, our evidence review showed little that documented experiences of disabled researchers.

5. Conclusion

This evidence review on peer review bias in the funding process set out to document evidence for both obstacles within the funding process as well as the interventions to overcome those obstacles. The literature that documents obstacles for women, early career and ethnic minority researchers is relatively rich, with gender being the most prominent category we found in our corpus of literature outputs. Women's experiences as applicants as well as the impact of their increasing inclusion as reviewers and assessors has been discussed across all stages of the funding process. Obstacles for early career and ethnic minority researchers as applicants, as well as calls for their inclusion as reviewers, were also found, but to a much lesser extent. We found very little evidence for experiences of disabled researchers and no accounts for any of the other protected characteristics of the Equality Act (2010).

We also found very little evidence for the effectiveness of any proposed interventions. The evidence review shows that all councils plan to play active roles in changing the funding process to make it more equitable, which is a positive finding. The initiatives are, however, still in their early stages, and all still require testing and refining. One of the first steps that has been taken is the collection and annual publication of EDI data on who receives funding from UKRI councils. This is in response to calls for more transparency, but our evidence review shows that this data only offers a partial picture of experiences in the funding process. Looking beyond established categories and investigating what data has so far been overlooked is a crucial first step to make the funding process truly inclusive.

As shown on the heatmap in **Appendix A**, most research focuses on the final stages of the funding process. There are large gaps in evidence for processes that precede the submission of a funding bid. This includes multiple factors that enable applicants to prepare a competitive bid for large-scale funding, like the impact of professional networks that can advise or collaborate and internal funding bid review processes. There is also little evidence on the preparation of the review process by funders. While there are efforts to make panels more diverse, there is no evidence on effective EDI training methods for panel members and chairs.

Evidence review: Peer review bias in the funding process

More research is needed to understand obstacles and enablers for marginalised scholars in every stage of the funding process. This evidence review is a work in progress and will add new evidence and results as the EDICa project continues and seeks to co-design interventions that remove barriers outlined in this review.

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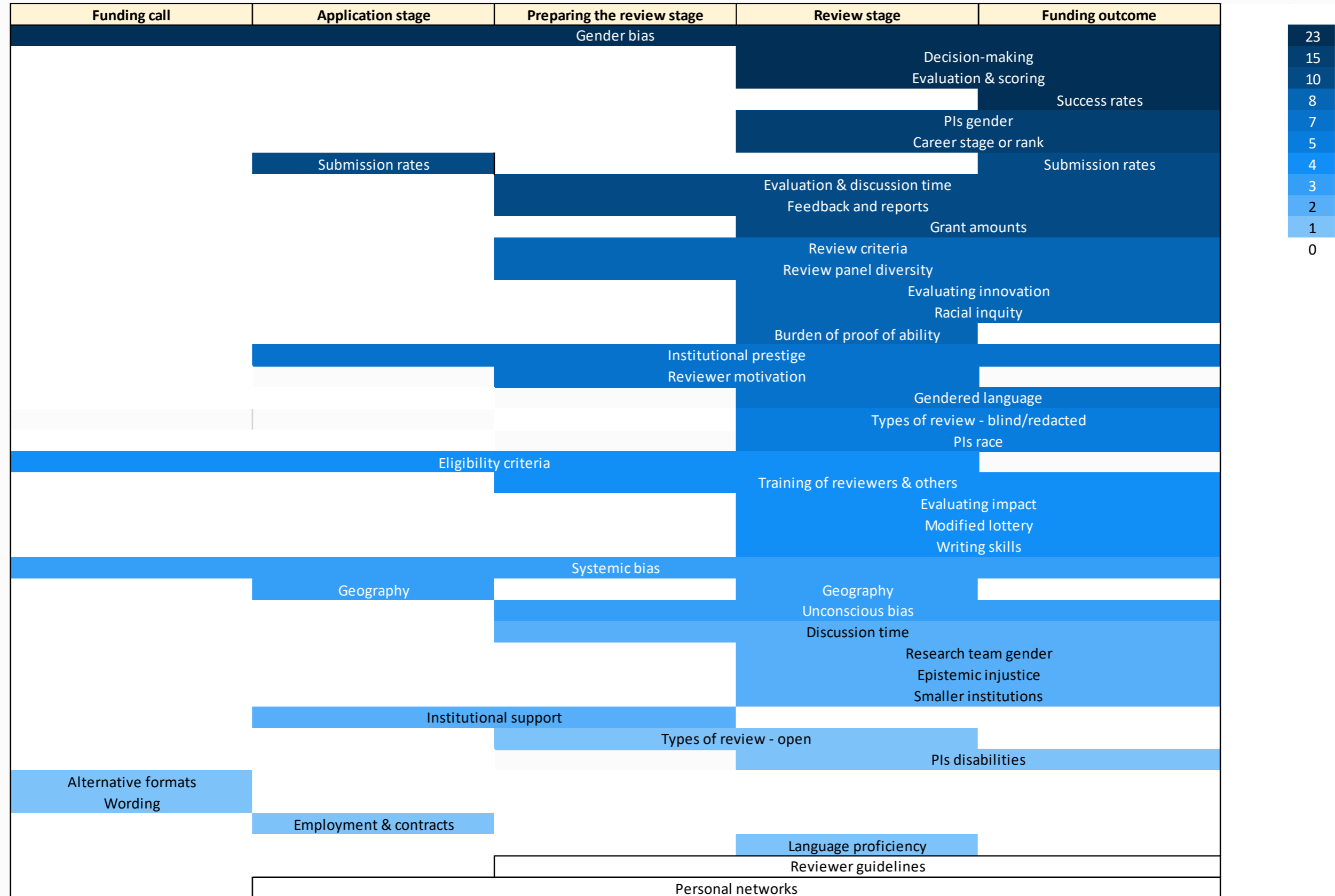
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Appendix A: Heatmap of themes identified in literature



Appendix B: Heatmap of themes identified in funder documents

Pre-funding call	Preparing the review stage	Review stage	Funding outcome
	Review criteria		
		Reducing bias	
		Feedback quality	
		Unconscious bias	
		Gender bias	
Embedding EDI	Training of reviewers & others		Accountability
		Evaluation & scoring	
		Career stage or rank	
			Impact
			Visibility
		Review panel diversity	
	Types of review - blind/redacted		
	Reviewer motivation		
		Institutional prestige	
		Racial disparity	
		Linguistic bias	
		Decision-making	
Application design Eligibility criteria Wording Evaluating interventions			
			Grant amounts
	Systemic bias		
		Personal networks	

About EDICa

The EDI Caucus is a multidisciplinary, £4M project funded by UKRI and the British Academy over three years to create inclusive careers across the UK's research and innovation systems. To achieve global excellence in research and innovation, the research workforce must bring a diversity of experiences, expertise and ideas which necessitates the creation of inclusive research cultures to remove barriers for marginalised researchers in order to meet UKRI's UK-wide talent programme and research concordats on responsible research practices. EDICa will act as a focal point, identifying, evaluating and synthesising EDI initiatives across the research and innovation systems ensuring research addresses the needs of a diverse range of stakeholders.

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