Policy Brief

Interdisciplinary research: constructing a level playing field

Interdisciplinary research is an essential ingredient in the quest to solve grand societal challenges and facilitate research breakthroughs, but there are numerous barriers to conducting such research. The Research Council of Norway's International Advisory Board recommends that these must be overcome through targeted measures in three key areas: Assessment and funding; education and careers; and leadership and cultures. Ultimately, there should be a level playing field for outstanding research, be it disciplinary or interdisciplinary.

Interdisciplinary research[1] is gaining traction and importance as research and innovation investments are increasingly geared on the one hand to solving grand societal challenges and on the other hand to nurture excellent research. Interdisciplinary research is essential to achieving both aims.

The most pressing challenges facing society do not present themselves to academics in categories established within traditional disciplines. Helping solve such grand societal challenges through science often requires collaboration, methods, and approaches that cross boundaries between different disciplines and advance new research methods.

Extensive research shows that interdisciplinarity is also an important element in the quest for research breakthroughs[2,3]; these occur more often among researchers who work within several different fields of research and who internalize significant scientific diversity[4]. For example, half of the recipients in the European Research Council's first call for Starting Grants had made a significant change of research fields two or more times in their careers[5].

Qualitative and quantitative evidence also exists on the positive relationship between interdisciplinary research and societal impact. For example, over 80 per cent of the 6,679 impact case studies submitted to the 2014 UK Research Excellence Framework (REF) included research that was multidisciplinary[6].

There are consequently good reasons to actively encourage and nurture interdisciplinary research. However, several obstacles need to be overcome if such research is to be more widely implemented. These obstacles reflect the structures of the academic research system, including its institutions, funding, review and reward structures. A recent case study review of Norwegian interdisciplinary research[7] finds that key stakeholders estimate that the most important challenges to conducting interdisciplinary research in Norway are:

- the disciplinary nature of many Norwegian educational degree programmes, which results in a lack of interdisciplinary skills development

- the disciplinary organisation of universities (e.g. faculties) and related administrative and financial systems

- disciplinary differences in conceptual understanding, norms and methodological requirements

- difficulty of publishing interdisciplinary research in top-rated journals. Linked to this, the National Science Index is perceived to systematically favour publications in disciplinary journals and as publishing is linked to funding, providing economic disincentives to interdisciplinary publishing.

While it is key to differentiate fact from stakeholders' perception, the perception of a barrier can have similar effects as a real barrier and demands attention.

The barriers identified in the case study are not specific to the Norwegian context, but stem from the nature of interdisciplinary research activity itself. The case-study findings are thus largely echoed in the literature, which highlight that the disciplinary nature of research institutions hinder interdisciplinarity [8], and that the current education system remains geared towards specialisation in a single discipline and consequently reinforces disciplinary institutions [9]. Furthermore, disciplinary norms, jargon, concepts and methodological conventions can obstruct knowledge exchange between disciplines, making it difficult to develop a common language [10]. A common language in turn is key for researchers to engage in scientific knowledge creation across disciplinary boundaries. Overall, research that crosses disciplinary boundaries demands additional effort and resources from researchers [11]. There is also evidence that peer review may disfavour interdisciplinary research [12] and that consequently publishing and obtaining funding for interdisciplinary research can be a problem.

Based on the findings in the case study review of interdisciplinary research in Norway [13] and the general literature on the subject, the Research Council of Norway's International Advisory Board recommends that interdisciplinarity is promoted through three key areas: Assessment and funding; education and careers; and institutions and cultures.

Assessment and funding
Evaluating and funding interdisciplinary research is challenging due to the need to evaluate multiple disciplinary contributions and the extra dimensions of team–building, team–working and management that interdisciplinary research calls upon. Research suggests that peer review may disfavour interdisciplinary research [14,15,16] and that increased interdisciplinarity in research proposals leads to lower success rates [17]. To ensure that interdisciplinary research funding and review take proper account of this challenge, adaptations are necessary in three key areas: The design of the call process; the selection of reviewers; and the design of the review process.

The design of the call process
RCN should aim to co-create interdisciplinary research funding priorities in close cooperation with relevant stakeholders. Getting different disciplines and users to work together from the start will help ensure that research questions are framed in such a way that input from a range of knowledge areas and methodological approaches are required [18]. Methods for developing interdisciplinary research calls include scoping studies, workshops, sandpits/"idélabs", etc.

When designing interdisciplinary research calls, the design needs to factor in that interdisciplinary research often requires more time and resources than monodisciplinary research due to the need to build relationships, coordinate among specialists, and allow co-learning and integration across disciplines. A level of flexibility to accommodate that projects may evolve is also necessary. Potential strategies to meet the need for additional resources include offering small planning grants for new interdisciplinary research projects and spreading a grant over a longer period to allow time for the team and work to develop [19].

The selection of reviewers
The composition of review panels is critical in the assessment of interdisciplinary research. Research suggests that reviewers favour proposals in their own fields that align with their ways of thinking – so called cognitive particularism [20,21,22]. Meeting this challenge by merely drawing reviewers from a wide range of disciplines carries the risk that panels will resort to judging the quality of each disciplinary element, effectively filtering out interdisciplinary research proposals on single-disciplinary grounds rather than recognising the quality of the whole [23]. There is a clear need to also employ reviewers with expertise in identifying good interdisciplinary research, preferably with a track record in carrying out effective interdisciplinary research themselves.

The design of the review process
Research funders need to support reviewers in carrying out good practice interdisciplinary research review. Evidence suggests reviewer training can have a significant effect on reviewer behaviour [24]. Information should be made available to reviewers prior to the individual review of applications (written briefing material, webinar, training video, etc.), and additional time should be set aside at the start of panel meetings to develop a common understanding of the challenges associated with interdisciplinary research and the criteria by which interdisciplinary research proposals should be judged.

To help ensure reviewers evaluate the whole and not just disciplinary parts of interdisciplinary research proposals, review questions should be developed to aid the examination of the quality of the whole. Several suggested frameworks for interdisciplinary research assessment exist that can be taken as a point of departure for developing an appropriate set of review questions [25,26,27].

The use of quantitative criteria in the review process such as citation counts and Journal Impact Factors should not be used, as interdisciplinary research may be less likely to appear in high–ranking journals and takes longer to have an impact [28]. This commitment should be made explicit through signing and adhering to the San Francisco Declaration on Research Assessment (DORA)[29] which advocates abandoning the use of journal impact factors for evaluating research.

IAB recommends that RCN should consider:

- Further developing monitoring of its peer review processes for awarding research funding with a view to allay concerns regarding bias against interdisciplinary proposals

- Further developing approaches to co-create its interdisciplinary research funding priorities in close cooperation with stakeholders from relevant disciplines and user communities, factoring in that interdisciplinary research may take more time and require more resources than monodisciplinary research

- Building on its current approach for recruiting review panels, ensuring that interdisciplinary research assessment panels are populated with a diversity of expertise including interdisciplinary practice

- Providing coaching to reviewers in good interdisciplinary research assessment practice and embed good practice in the review process

Education and careers

University education and career structures do not favour interdisciplinary research. Institutions need to take active steps to counteract this, focusing on three key areas: Flexible education programs; appropriate career incentives; and support for external engagement.

Education programs

The discipline–based system of education should be adapted to align better with the needs and the dynamic state of knowledge outside the academic world. It should enable more problem- or theme based learning that necessitates the critical integration of multiple bodies of knowledge. An improved framework for interdisciplinary education would also be conducive to the needs of the academic world. Research suggests scientists educated in the American liberal arts tradition - a general degree that covers a broad array of academic topics - are disproportionately successful in research careers [30,31]. Typically, highly creative researchers have a rather broad research profile. They tend to cooperate in larger networks, connect peers that normally do not cooperate and publish in a large variety of journals [32,33,34].

In the long term there is a need to explore the need for and potential benefits associated with a rather fundamental restructuring of the approaches to higher education. In the short term there is a need to assess how the current system can be tweaked in a more interdisciplinary direction. For example, improved mentoring and increased possibilities for "cross-listing" of courses (in which the same course gives credit in several different departments or study programmes) for students wishing to undertake an interdisciplinary education could be explored. Also, using practitioners more systematically in student teaching could be investigated, for example by introducing the position of "professor of practice" in the Norwegian higher education system.

Career incentives

As peer review may disfavour interdisciplinary research, institutions that place more value on journal articles and impact factors than other types of outputs and impacts, risk hampering career progression for interdisciplinary researchers [35]. Moreover, a strong focus on evidence of 'leadership' and 'independence' in career progression decisions may disfavour interdisciplinary researchers, as this may be hard to prove in collaborative modes of working [36]. Interdisciplinary research can also take longer to bear results owing to the necessity of coordinating a team, educating oneself in another discipline and keeping abreast of developments in more than one field [37]. Furthermore, researchers may have to compromise their domain-specific standards of excellence to meet cross-domain requirements [38]. Interdisciplinary research may also expose researchers to career and professional risks because of leaving known disciplinary communities and established research trajectories [39,40,41]. These can be major disincentives for researchers trying to build careers.

To ensure a level playing field for interdisciplinary and monodisciplinary researchers, recruitment, promotion and funding criteria should make explicit mention of interdisciplinary research value and clarify the mechanisms through which it is evaluated. The use of journal impact factors should be avoided, and institutions should sign and adhere to the San Francisco Declaration on Research Assessment (DORA)[42] which advocates abandoning the use of journal impact factors for recruitment/promotion purposes.

Although disincentives apply throughout academic careers, established academics in permanent posts arguably face fewer disincentives to carry out interdisciplinary research than more junior ones. This means that, despite the intuition that universities and research agencies should develop interdisciplinary research incentives directed towards younger researchers, the payoff from building incentives for older researchers should not be overlooked[43].

Training in interdisciplinary research practice and methodology should be available at all career levels, including active support in setting up interdisciplinary research projects and teams and in project management. Mentoring in career planning from senior academics with experience in interdisciplinary research should be available to early career researchers.

External engagement
In seeking to develop an appropriate framework for building interdisciplinary research careers, support should be given for engagement with research users and external partners. In many cases, this is central to the successful development of a career in interdisciplinary research[44], and studies have shown that the extent of university interdisciplinary research is strongly correlated with the intensity of university-industry connections[45,46].

IAB recommends that RCN should consider:

■ Reviewing its funding schemes in order to establish if these provide appropriate incentives for interdisciplinary research careers - both at early and later career stages

Research and higher education institutions should consider:

■ Assessing how more flexibility and interdisciplinarity can be introduced in education programmes

■ Reviewing career incentives and take appropriate measures to ensure they do not discriminate interdisciplinary research

■ Providing career planning schemes for interdisciplinary research, including support for engagement with research users and external partners

■ Providing opportunities for training in best practice interdisciplinary research

The government should consider:

■ Appointing a committee tasked with assessing how the higher education system more effectively can cultivate the interdisciplinary skill sets and approaches needed in a modern knowledge society

Leadership and cultures

Disciplinary norms and expectations, as well as discipline-oriented structures such as university departments, can act as barriers against engagement between disciplines. Institutions need to take active steps to counteract this, focusing on three key areas: clearly articulated commitment to interdisciplinary research; targeted support for interdisciplinary research; and a supportive research environment.

Articulated commitment to interdisciplinary research

Active institutional leadership, which clearly convey support for interdisciplinary research, is an important counterweight to the very real constraints that structural disciplinarity imposes, allowing researchers to explore interdisciplinary research projects with confidence that this work will be valued appropriately.

Involvement of key staff as 'champions of interdisciplinarity' can help to increase the visibility of the institution's interdisciplinary research internally as well as externally and to embed it in institutional structures and culture. The University of Bergen's establishment of the position of Vice Rector of interdisciplinary affairs and large projects is a good example in this respect.

Targeted support for interdisciplinary research

Specific interdisciplinary research support measures and targeted efforts aimed at reducing disciplinary-based barriers have an important role to play in nurturing interdisciplinary research.

Initiatives such as cross-faculty themes, centres and clusters help to overcome disciplinary boundaries and create an increased awareness of the potential for building collaborations, which in turn might encourage bottom-up initiatives from the faculty. A good example in this respect are the Arctic University of Norway's annual calls for interdisciplinary research proposals within its five research priority themes, which require collaboration between at least three faculties.

Awarding seed funding for interdisciplinary research projects is also a valuable way to legitimise and support interdisciplinary research activity. This has proved effective in English HEIs and could be considered as a supplement to the internal funding awarded for interdisciplinary research in Norwegian HEIs, which is usually more substantial and over a longer term (years rather than months).

In addition, creating opportunities for people with different disciplinary backgrounds and expertise to interact and exchange ideas, both formally through seminars, conferences and workshops or informally through lunch meetings and coffee mornings can be instrumental in growing and embedding interdisciplinary research.

Moreover, building down administrative barriers to interdisciplinary research is key. It can be challenging to reconcile the disciplinary–based structures for organising research and teaching activities and associated resources, and the cross–cutting structures needed to support interdisciplinary research and provide interdisciplinary teaching. Institutions need to establish strategies that will enable greater flexibility for collaboration between different faculties, including specific strategies for managing income across disciplinary and interdisciplinary structures and units.

A supportive research environment

Contrasting interpretations of evidence and rigour as well as different methodological requirements can create friction and misunderstanding within interdisciplinary research teams. Successful interdisciplinary research teams are characterised by equality, mutual acceptance, trust and openness among the team members[47,48,49]. It is also important to recruit the right mix of disciplines, expertise and personalities to the team and to create structures for communication, team working and evaluation, ensuring that interdependencies among knowledge areas are appropriately handled and that team structures are adapted as needed[50,51]. Moreover, strong project leaders with a clear vision and good interpersonal and team building skills are essential for the success of interdisciplinary projects[52,53].

Universities should offer researchers leadership training, providing guidance in how to lead an interdisciplinary team. They should also find ways for experienced and established interdisciplinary researchers to mentor and guide interdisciplinary projects, as well as playing a role in strategic advice at university level in promoting a research environment supportive of interdisciplinary research.

IAB recommends that

Research and higher education institutions should consider:

■ Clearly articulating commitment to interdisciplinary research and introducing concrete support measures.

■ Evaluating their ongoing interdisciplinary research activity and support structures and on this basis, develop evidence-based institutional strategies for interdisciplinary support.

The government should consider:

■ Using the institutional performance agreements[54] currently being tested in some universities to incentivise enhanced interdisciplinary support, based on clear institutional strategies for interdisciplinary research.

The Research Council of Norway's International Advisory Board recommends that obstacles to conducting interdisciplinary research must be overcome through targeted measures in three key areas:

1. Assessment and funding

RCN should consider:

- Further developing monitoring of its peer review processes for awarding research funding with a view to allay concerns regarding bias against interdisciplinary proposals

- Further developing approaches to co-create its interdisciplinary research funding priorities in close cooperation with stakeholders from relevant disciplines and user communities, factoring in that interdisciplinary research may take more time and require more resources than monodisciplinary research

- Building on its current approach for recruiting review panels, ensuring that interdisciplinary research assessment panels are populated with a diversity of expertise including interdisciplinary practice

- Providing coaching to reviewers in good interdisciplinary research assessment practice and embed good practice in the review process

2. Education and careers

RCN should consider:

- Reviewing its funding schemes in order to establish if these provide appropriate incentives for interdisciplinary research careers - both at early and later career stages

Research and higher education institutions should consider:

- Assessing how more flexibility and interdisciplinarity can be introduced in education programmes

- Reviewing career incentives and take appropriate measures to ensure they do not discriminate interdisciplinary research

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- Providing career planning schemes for interdisciplinary research, including support for engagement with research users and external partners

- Providing opportunities for training in best practice interdisciplinary research

The government should consider:

- Appointing a committee tasked with assessing how the higher education system more effectively can cultivate the interdisciplinary skill sets and approaches needed in a modern knowledge society

3. Leadership and cultures

Research and higher education institutions should consider:

- Clearly articulating commitment to interdisciplinary research and introducing concrete support measures

- Evaluating their ongoing interdisciplinary research activity and support structures and on this basis, develop evidence-based institutional strategies for interdisciplinary support

The government should consider:

- Using the institutional performance agreements currently being tested in some universities to incentivise enhanced interdisciplinary support, based on clear institutional strategies for interdisciplinary research

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1) Multiple variants of the concept of interdisciplinarity exist (intra-, multi-, pluri, trans-, crossdisciplinary), but the distinction between multidisciplinarity, a conglomeration of disciplinary components, and interdisciplinarity, a more synthetic attempt of mutual interaction, has been the most influential. While "interdisciplinarity" has this specific meaning, it also remains the generic concept which includes all activities that combine, integrate or transcend parts of two or more disciplines (Huutoniemi, K., Thompson, J., Klein, T., Bruun, H., Hukkinen, J. (2010): Analyzing interdisciplinarity: Typology and indicators). In this text, interdisciplinarity is used in this latter sense.

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Design and layout: Burson Cohn & Wolfe AS