Interdisciplinary Research Collaborations: Evaluation of a Funding Program

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ABSTRACT

Innovative ideas are often situated where disciplines meet, and socio-economic problems generally require contributions from several disciplines. Ways to stimulate interdisciplinary research collaborations are therefore an increasing point of attention for science policy. There is concern that 'regular' funding programs, involving advice from disciplinary experts and discipline-bound viewpoints, may not adequately stimulate, select or evaluate this kind of research. This has led to specific policies aimed at interdisciplinary research in many countries. There is however at this moment no generally accepted method to adequately select and evaluate interdisciplinary research. In the vast context of different forms of interdisciplinarity, this paper aims to contribute to the debate on best practices to stimulate and support interdisciplinary research collaborations. It describes the selection procedures and results of a university program supporting networks formed 'bottom up', integrating expertise from different disciplines. The program's recent evaluation indicates that it is successful in selecting and supporting the interdisciplinary synergies aimed for, responding to a need experienced in the field. The analysis further confirms that potential for interdisciplinary collaboration is present in all disciplines.

INTRODUCTION

The term 'interdisciplinarity' is used in relation to many different manifestations of the phenomenon, involving different actors, sectors and interactions. The various kinds of interdisciplinarity have been listed, codified and studied from practical experiences (Klein [1]; Frodeman, Klein and Mitcham [2]; Weingart and Stehr [3]) as well as from a cognitive point of view (Derry, Schunn and Gernsbacher [4]). A concise and up to date taxonomy of interdisciplinarity in general is given by Klein [5]. Looking more specifically at interdisciplinarity in research, the need for crossing the boundaries of research disciplines is a natural phenomenon. The reality that one wishes to study and describe remains a complex, 'interdisciplinary' combination of aspects and properties, regardless of the disciplinary delineations installed by man. From this point of view, combinations of knowledge originating from several such 'artificially' separated disciplines are equally valuable in their potential to advance science as those stemming from a same discipline. Efforts to categorize and order human knowledge have accompanied its development since the beginning. The present division of scientific knowledge in disciplines (physics, chemistry, ...) emerged about two centuries ago as researchers got organized in more focused communities, being confronted with growing amounts of scientific information produced and communicated. These large disciplines remained relatively stable and became institutionalized in higher education structures, where they have been shaping knowledge production, funding and distribution. Not long after the introduction of

disciplinary boundaries, these were subject to opposition from the Unity of Science Movement, striving for one single scientific language (Neurath, Carnap and Morris [6]), and a seminal study on interdisciplinarity appeared, linked to the first international conference on the subject sponsored by the OECD (Apostel et al. [7]). Presently, the idea that the current structural disciplinary organization hampers potentially valuable and innovative interdisciplinary interactions is widely accepted.

2. Program procedures and criteria

The 'Horizontal Research Actions' (HOA) program was set up at the Vrije Universiteit Brussel in 2002, to support research collaborations integrating expertise from different disciplines, around topics proposed by the applicants. Seven calls have been issued since then, until the program was evaluated in 2009 (Table 1). Criteria for ex ante evaluation of the applications concern both the topic (interdisciplinary and innovative character, completeness and added value of the collaboration, importance for science and society) and the strength of the network partners. The program indeed aims to support joint initiatives of excellent teams, expecting that strong disciplinary performance is required for successful interdisciplinary collaborations. Selected projects are funded initially for two years, in the majority of cases extended until four years after mid-term evaluation. Crucial in the ex ante evaluation by peers of interdisciplinary research initiatives is the composition and functioning of the evaluation committee (Langfeldt [28]; Lamont, Mallard and Guetzkow [29]). Several aspects may hamper a correct evaluation of the quality of the proposed research, such as a partial coverage of the whole of the fields concerned, conflicting assumptions regarding quality and discipline related bias. For the HOA program, the university's tradition in peer review evaluations was extended with a new form of assessment. The evaluation committee is not composed of experts from each of the particular fields of the network partners, but consists of the members of the Board of the Research Council. As a committee, these combine the broad scope, open attitude to different standards and coherence required for a comparative assessment of the interdisciplinary applications. Linked to their function and experience on the Board, all committee members have acquired a good overview of the expertise and performance of the university's teams in the large domains that they represent (i.e. one of the faculty clusters 'Social Sciences and Humanities', 'Basic, Natural and Applied Sciences' or 'Biomedical Sciences', corresponding to the domains of three permanent committees of the Research Council) and even beyond. Their views are expected to surpass disciplinary perspectives and stand above conservative disciplinary forces.

The Board of the Research Council selects applications in two phases (Table 2). In a first pre-selection phase, the members of the Board use knowledge of performance levels previously demonstrated by the teams, and concentrate on the extent to which the applications meet the program's aims related to the interdisciplinary collaboration, including the extent to which an all-encompassing expertise is offered in the proposed theme and the potential added value of the project for science and society. These criteria correspond to how panel members for the evaluation of multidisciplinary fellowship applications for themselves define a good

interdisciplinary proposal, i.e. having the capacity to achieve the stated purpose, combining breath and originality with a mastering of the research tools from the different disciplines (Lamont, Mallard and Guetzkow [29]). A good selection on this basis also ensures that the funded projects hold the necessary features to later score on the three fundamental grounds suggested by researchers from interdisciplinary research institutes to examine the quality of interdisciplinary research outcomes, i.e. (1) consistency with multiple disciplinary antecedents, (2) balance in weaving together perspectives, and (3) effectiveness in advancing understanding (Feller [30]). For each application (at least) two reviews are collected: one by a member of the Board and one by an additional experienced reviewer, both not involved in the applications. The members of the Board present their own reviews as well as those of their 'co-reviewers' to the Board, which makes the pre-selection.

In a second phase, the applicants of the pre-selected projects are invited to present and defend their project before the Board. After each presentation, remaining questions and specific points of attention are discussed. The HOA funding is intended to be spent primarily on one or more researchers embodying the integration of expertise from the different disciplines. The way the teams plan to fill in these positions is an important point of attention in this second phase of the evaluation. Also, where long term potential is present, the support by the Research Council is expected to lead to the attraction of external funding to ensure the continuation of the network, and the teams' strategies to this respect are another point of attention. After all presentations and discussions, the Board formulates its final advice for selection to the Research Council.

3. Program evaluation: method and phases

The 'Horizontal Research Actions' program started out with a modest budget that was soon enlarged after it appeared to attract many valuable applications. It was evaluated in 2009, when the first four generations of applications could be followed for three years after the start of funding. The evaluation of the program was conducted by the university's Research Coordination Unit and consisted of three consecutive phases, investigating (I) the degree of interdisciplinarity of the networks and faculty participation, (II) the interdisciplinary scientific output and citation impact, and (III) validation by the networks of the data In phase I, the degree of interdisciplinarity of all funded and unfunded networks was analyzed based on the affiliations of the applicants to departments and faculties. A distinction was made between "broad", "medium" and "narrow" interdisciplinary collaborations, respectively joining applicants from different faculty clusters (broad), from different faculties within one cluster (medium), and from different departments within one faculty (narrow). A similar distinction between "big" and "small" interdisciplinarity, standing for predominance of links between distant areas versus close disciplines, was used before by Morillo, Bordons and Gómez [31], based on the terminology from Schmoch et al. [32]. Both divisions are consistent with the terminology from integrative studies discerning the concepts of "narrow" and "broad" interdisciplinarity, where narrow interdisciplinarity refers to interaction between disciplines with comparable methods and paradigms (such as history and literature)

and broad interdisciplinarity refers to interaction between disciplines with clearly different paradigms and methods (such as disciplines from sciences and humanities). In phase II, interdisciplinary output and citation impact were analyzed based on the on line Web of Science, for the first four generations of applications (funded and unfunded), which could be followed for at least three years after start of funding. Of the 36 applications concerned, 4 networks completely situated in 'Social Sciences and Humanities' were excluded from this bibliometric analysis, due to insufficient coverage of such networks. Output was measured by "co-publications", defined as joint publications by applicants from different departments.

4. Program evaluation: results

4.1. Degree of interdisciplinarity and faculty participation

All eight of the university's faculties are represented among the applicants. The faculties' shares of (co)applicants are well correlated with the faculties' shares of potential (co)applicants, which are the leading academic staff (Figure 1). This shows that a potential for interdisciplinary collaboration and a need for specific funding are present in all faculties, and that no faculty in particular is much more predestined than another to engage in interdisciplinary research. It nevertheless can be observed that the larger faculties tend to be over-represented among the applicants ('Medicine & Pharmacy' and 'Science & Bio-Engineering Sciences'), and the smaller faculties under-represented (in particular 'Law & Criminology', 'Economics and Social & Political Sciences' and 'Arts & Philosophy'). A possible explanation may be a scale effect, where a faculty's larger size creates a better environment from which to apply and participate in the program. Another explanation may be found in the 'natural' shares of cross-disciplinary activity of the disciplines themselves, as observed in bibliometric measures (Rinia et al. [17]).

4.2. Network activity and impact profiles

Based on their bibliometric interdisciplinary output and citation impact, the following profiles were distinguished among the applications, funded and unfunded:

A. "Newly activated": Newly activated collaborations generating output as well as citation impact. This category was present in particular among the funded applications, of which it contained half, while it was one of the smallest categories among the unfunded applications.
B. "Previously active": Continued previously active collaborations that were already generating output as well as citation impact before the year of application. This category contained about a quarter of the applications, both among the funded and unfunded.
C. "Output only": Newly activated collaborations generating output but not yet citation impact. This was overall the smallest category along with category D.

D. "Citation impact only": Networks not visible in output since application, yet generating joint citation impact. This was overall the smallest category along with category C.

E. "Not visible": Networks not visible in output, nor citation impact. This category was present in particular among the unfunded applications, of which it contained about half, while it was one of the smallest categories among the funded applications.

5. Conclusions

In the context of the ongoing search for best practices regarding the assessment of interdisciplinary research, the paper describes a recently evaluated university program designed to support 'bottom up' interdisciplinary networks, integrating expertise from different disciplines. As particular features, the program's two-phased selection procedure involves an evaluation committee consisting of the members of the Board of the Research Council, and an oral presentation of the pre-selected projects by the applicants. An analysis of the application data indicates that potential for interdisciplinary collaboration and a need for specific funding are present in all faculties and disciplines. A bibliometric study of the output and impact generated by the first generations of applications shows that the program was successful in selecting and supporting the interdisciplinary synergies that it aimed for.

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